The
Southern Surgeon

VOLUME IV APRIL, 1935 NUMBER 2

THE RELATION OF THE HEART TO SURGERY

STEWART R. ROBERTS, M. D., F. A. C. P.
Professor of Clinical Medicine, Emory University School of Medicine
Atlanta

HE was an old man. He was short and plump and in his seventieth year. For the last ten years his air spaces had been growing larger, their walls stretching and thinning, their partitions breaking down, and the burden upon the heart increasing. There was less lung, but more air and inflation. His chest was like a short, round barrel and, lying in bed, his sternum seemed to rise up at one. For twenty years he had been coughing and in the last five years he wheezed like an asthmatic in the winter evenings and in damp weather. Recently he was short of breath on walking, and on stairs and hills he could not walk and talk at the same time. When his wheezing was worst he was bluish about the lips, ears and finger tips. He had a store and lived indoors. He was known for his energy, his courtesy and his pipe. His pipe had done long and heavy duty and had an evil, sweetish odor like poison. It stayed in his mouth except when he was eating or sleeping. He bit at it with his teeth, sucked at it with his lips, and inhaled at it with his feeble respiratory effort. And then, to make matters worse, he had been ruptured for years on both sides. The family physician said the coughing probably brought on the ruptures at his age. He had worn trusses for many years. No one had ever said anything about an operation for the ruptures, but no one had ever seen him except his old and congenial family physician, and he smoked a heavy pipe, too, and was likewise feeble and sedentary.

Delivered at the Fifth Annual Banquet of The Southeastern Surgical Congress in Nashville, March 6, 1934.

Somehow he managed to get on and even claimed that he was well and had never been sick. But on February 1, this year, there came an ache in the left groin and a little round lump like a small marble. Then he grew weak and sickish and vomited. The family sent for their physician and surgeon. They examined the groin and waited. During the night the lump disappeared; he had a good movement of the bowels and was better. The surgeon came the next morning and with the family urged the hospital at once because he might have another strangulated lump. And so he went to the hospital immediately and the operation began that morning at 11 o'clock. He was good at groceries and politics, but all this was too fast and too much for him.

They lathered and shaved and scrubbed both groins and he was comforted by thinking that he was done with his awkward trusses. The surgeon said it would not hurt, he could smoke his pipe—he would be home in a week or ten days—but would have to stay in bed for three weeks. It was just a simple operation—thousands of them were done and his should have been done years before. He noticed the surgeon was more positive with his facts than the family doctor had been. Nothing had been said about expenses, but with a short stay in the hospital and a nurse for only a few days he could fall back on his savings if necessary. They gave him a hypodermic, he grew sleepy and went to the operating room. The surgeon did all his hernias under local anesthetic. The sacs were fibrous, difficult to separate, and the peritoneal linings extensive. The two operations lasted two and one-half hours. No one suggested doing one and waiting to do the other. There was some pain and the old man was rolled back to bed weak and all tired out.

By 9 that evening the trouble began. He was coughing and wheezing, mucus accumulated in his throat that he could not raise, the pulse up to 125, the respirations to 26 to 30 and shallow, a profuse perspiration, the blood pressure down to 120 mm. from 160 mm., and the old man was haggard and drawn. A young internist was called in. He examined every part of the body except the groins. The operations had been well done by a good operator who handled tissues well and made straight line incisions that healed by first intention. The internist said the patient had advanced emphysema, hypoven-

tilation of the lungs, disturbance of the respiratory center, a near asthmatic state, and a failing right heart associated with a moderate arteriosclerosis and coronary sclerosis. He noted albumin and casts in the urine, a rapid but not thready pulse, and a sick old man riding the postoperative rapids. He suggested oxygen-carbon dioxide inhalation, gradual digitalization, small doses of morphia, careful nursing, and glucose-saline solutions intravenously. He listened well, thought much, wondered a little, and wrote down some very definite directions. Three days later the urine output was decreased and the blood urea rose. The respirations reached 40, the pulse 140 and another internist was called. Gradually the old man lived through the ordeal. He went home on the twenty-second day instead of the seventh. There had been four doctors instead of one surgeon, and two nurses for three weeks. He had a pretty scar in each groin. His strength was off 75 per cent. He would have to wait to return to work. He was safer, wiser and weaker, and the doctors had learned a great deal. The family had been through many anxious days and sleepless nights.

Some such picture as this, and with too often an unfavorable outcome, is repeated frequently in the average hospital. A hundred papers have been written with the same title as this or a similar one. They are all written by internists and cardiologists who know little of surgery. They are not written by surgeons who know little of the heart. In our story, the internist was not thought of until after the operation. He was greatly needed before the operation, not only that he and the surgeon might do group thinking and cooperate for the safety of the patient, but that he might not be needed after the operation. His coming depended upon the invitation of the surgeon. So far as is known, no careful clinical study was made of the patient. The surgeon and the patient sailed away alone. It was fair neither to the patient nor to the surgeon. When the clinical storm arose, it was a medical storm. It is so much better to prevent a storm than to raise one or to attempt to quiet one already full blown. Nor is the safety of any patient increased by saying that this may not happen once in a hundred surgical patients. A majority of surgical patients have normal hearts, but the surgeon never knows which patient has a normal heart unless the heart of every

patient is carefully studied before operation. The surgeon lives and works with his patients on their somatic level,—the internist on the somatic level, but also on the instinctive, the emotional and the psychic levels as well. The surgeon seems more concerned with the condition of the patient's heart than with any other organ within the ken of the internist.

Each hospital requires that the heart and lungs be examined by the intern before operation, though this examination often is either omitted altogether or made with the fleeting exhibition of the stethoscope. But auscultation has come to be one of the lesser present day methods to determine the functional capacity of the heart. The surgeon is entitled to know also the physical limitations of his patient before operation. Galen declared that surgery is but a method of treatment. Genius though he was, his view was too narrow. Surgery is far more. It is a way of life and one of the chief glories of medicine and an art unto itself, but it cannot walk alone and attain its highest service and development. Neither can medicine walk alone without the surgeon nor obstetrics without both. The cerebral eye of the internist and the retinal eye of the surgeon together add to the safety of the patient. The one hears and observes clinically, purrs over his patients, sagaciously observes and pliably and keenly concludes. The other comes with power, technic and courage and an amazing execution in the field of his particular operation. Recovery depends upon the functional capacity of the circulation and the organism as a whole. It is rest, safety and conservation versus risk, pain and danger. And no one of us can stand very much mortality. W. J. Mayo wisely said last year: "Add a fact, change the outlook, and you have a new truth. Truth is a constant variable. We seek it, we find it, our viewpoint changes, and the truth changes to meet it."

Heart disease is apparently increasing. One reason for this increase is a larger number of old people than formerly. From 1900 to 1932 the population increased 62 per cent, and the number of people over 45 years of age more than doubled. In these 32 years there has been an increase of 60 per cent in deaths from heart disease. In 1929 in the registration area of the continental United States there were nearly 250,000 deaths from heart disease, or more than double those from

cancer, which is second numerically. In New York State in 1930, the six leading causes of death in decreasing order were 277 per 100,000 from heart disease; 123 from cancer; pneumonia, all forms, 102; accidents 81; acute and chronic nephritis 77; tuberculosis, all forms, 71. In that State for every death from cancer there are 2.25 deaths from heart disease. Not only is heart disease the leading cause of death, but it ranks second only to rheumatism and arthritis as a cause of disability. Bigelow and Lombard estimate 84,000 persons ill of heart disease in Massachusetts. This is far higher than the proportion in the Southern States for two reasons: first, the average age in Massachusetts is higher than in the country at large; and secondly, there is more rheumatic fever in Massachusetts than in the country at large or in the Southern States as a region, and therefore more rheumatic heart disease. In the South, heart disease averages 1 in every 300 to 500 pregnant women, and in Massachusetts 1 in every 100. The frequency of rheumatic fever in the North and in cold countries is the chief cause of heart disease in pregnant women. Its rarity in the South is the chief cause of the infrequency of heart disease in pregnancy. In Carr and Hamilton's series from Boston, of 45,069 pregnant women, 500 of them, or 1 in 90 suffered with serious heart disease. Of these, rheumatic heart disease accounted for 472 or 94.4 per cent, congenital heart disease for 12 or 2.4 per cent, and a miscellaneous group for 16 or 3.2 per cent. Had the rheumatic heart been absent, the ratio would have been one in 1408 pregnancies. R. A. Bartholomew, of Atlanta, out of 3,000 private obstetric patients during fifteen years, has had only five distinct cardiac patients, of whom only two had rheumatic hearts with mitral stenosis and three hypertensive hearts with congestive failure. J. R. McCord, of the Department of Obstetrics at Emory, with an average of 1,800 deliveries per year in negroes, has never seen a case of mitral stenosis, but averages five cases of hypertensive heart disease annually with one to two cardiac deaths. In his last 2,674 deliveries in negro women at Emory University, there were only ten cases of serious heart disease. Adding these two series, of 5,674 deliveries there were only fifteen cases of serious heart disease, or 1 in 378 cases. Of these fifteen cases, only two were due to rheumatic fever or 0.035 per cent; five

due to syphilitic aortitis; and the remaining eleven to hypertensive heart failure. In Nashville, 250 miles north, Laws reports 10.5 per cent of rheumatic hearts in 645 cases of heart disease with only 4.3 per cent in negroes, whereas 15.4 per cent of the negro cases had syphilitic heart disease. In the cities of the South at least, rheumatic heart disease is relatively rare in the negro and syphilitic heart disease relatively common.

Vermont leads with 304 deaths per 100,000. The colder states with more rheumatism give a larger proportion of heart disease and deaths. Tennessee has only 135 deaths and Georgia 143. The Welfare Council of New York City shows that 1 of 8 chronically ill persons suffers from heart disease, not including old people, many of whom have cardiovascular disease of some type. It is believed that there are 2,000,000 sufferers from heart disease in the United States. Under present mortality trends and rates, one of every five white males born will probably die from heart disease, and a slightly larger ratio of white females. As one grows older the chances increase so that at the age of 45 one of every four females and at 50 one of every four males will die from heart disease. Of course, these figures include the senescent cardiovascular changes in the very old. Taking the New York statistics for a model for the northeastern region of the country, one has a greater probability of dying of heart disease than of cancer, nephritis and tuberculosis combined. It is generally estimated in the colder regions that 90 per cent of heart disease under 20 is due to rheumatic fever. The late Cary F. Coombs, of Bristol, England, told me that 25 per cent of his private practice and 50 per cent of his hospital practice was devoted to rheumatic fever, including, of course, the rheumatic heart.

In the Southern States these figures vary greatly. It is estimated that 75 per cent of heart disease in these States is due to essential hypertension, of which two-thirds ends in congestive failure and one-third in coronary disease including coronary sclerosis, thrombosis and angina pectoris. In the South, except in the extreme mountainous areas, we are spared the large proportion of rheumatic fever characteristic of the colder climates and hence have less heart disease, less disability from this cause and fewer heart deaths proportionately and actually. Typhoid fever in comparative registra-

tion areas in 1900 averaged 31.3 per 100,000 and in 1932 only 1.1 deaths; diphtheria has dropped from 40.4 to 2.5; and tuberculosis, the leading cause of death in 1900, with a rate of 195.2 has now dropped to 58.7, so that ultimately it will probably be a minor item in the annual death rate. On the other hand, comparatively little has been accomplished in the reduction of rheumatic fever. Some advance has been made in the early recognition and treatment of cardiovascular syphilis, but little if any in the reduction of heart disease due to hypertension, arteriosclerosis and angina. The latter group seems actually to be increasing in Europe and America. Whatever problem heart disease may be in its relation to surgery, it seems at least for the present and near future, an increasing problem.

Both White and Lewis discuss this subject in their recent books. Long ago the elder Oschner said, "I think it would be unfortunate should surgeons receive the impression that patients suffering from heart disease are especially safe. I believe they are safe because they are considered especially unsafe." Sprague discussing ten years' experience at the Massachusetts General Hospital with surgical results on cardiac patients adds, "I should be inclined to agree with this statement, and so long as surgeons consider cardiac patients 'especially unsafe,' I believe that their future in the hands of the surgeon is relatively bright." H. M. Marvin at Yale, J. M. Blackford and Willius take the more optimistic view; Lewis, Sprague, Levine, Rountree and Thomas McCrae an optimism tinged with a healthy conservatism. Certain general questions and considerations naturally arise in the surgeon's mind relative to the integrity of the heart and circulation in the patient who is a candidate for an operation. These questions afford broad principles which guide in the application of the more technical details.

The view prevails that an operation imposes an added burden on the heart and circulation. This view is probably true in a minority of major operations, untrue in a majority of such operations with due consideration given to preparation and anesthesia, and on the contrary certain operations, as thyriodectomy, cholecystectomy or prostatectomy, may temporarily burden the heart, but ultimately with recovery very much lighten its burden. At any rate, the surgeon desires

to know in his own language, and it is a very definite language, which internal medicine might imitate—"Is the patient's heart good or bad? Will the heart stand this operation which I plan to do?" His primary object is to bring the patient safely through the wear of the operation, the struggle of the delivery and the strain of the anesthetic. His questions pertain directly to the state of the circulation before operation. But the problem is not so simple. The operating room is a stage and the surgeon plays the part of the leading man, the patient is in the passive mood, and the others but assistants. The surgeon does something to the patient and this may change the condition of the heart or start a trend toward heart failure or shock. The surgeon's part includes the haste of operation, the preparation for operation, its length, the amount of blood lost, the extent of tissue damage, and the kind and length of the anesthetic and its influence. Then the third act may present circulatory disturbances subsequent to the operation.

It is relatively easy to tell a good heart. It is more difficult to prove a bad heart and still more difficult to state how bad it is. Not every normal heart meets every strain. Not every good heart is a normal heart and not every bad heart is a dangerous heart. The primary question is not whether the heart is anatomically normal, but rather whether it is functionally capable. The physical examination of the heart is important but it does not permit conclusions regarding its power to do work or to stand strain. One wishes to know the size of the heart, its sounds and murmurs, its rate, rhythm and peripheral blood pressure. This is the more objective and anatomic examination and has failed as a chief basis of thought in heart disease.

The subjective and functional examination is far more important for life and for surgery. What is the response of the heart to effort? Is it an easy, normal response or a labored, slowly or quickly breathless response? Can the heart do the day's work even though enlargement or murmur or slow or fast rate or irregularity or high or low pressure exists? One can measure the vital capacity with an ordinary spirometer. Should repeated readings at different times show a progressive decrease in the spirometer reading in liters, there is demonstrated an early sign of passive congestion of the lungs and

therefore of congestive heart failure. An even better test and simpler regards the onset of dyspnea on effort. If the patient can walk on the level, climb stairs and carry on a full day's work of ordinary activity without discomfort, he may be considered to have a functionally good heart and one capable of standing a reasonable anesthetic and operation. Such an opinion would have support in the absence of notable thickening of the palpable arteries, with normal retinal arteries and blood pressure, and no history of anginal attacks. As a general rule, digitalis is not indicated in this group. In normal hearts, it is contraindicated. Good rest, food and sleep with prudent preparation meet the preoperative needs.

A more difficult problem is presented by frankly bad or diseased hearts whose ability to do the day's work in terms of ordinary activity involves slight, moderate or even bed rest discomfort. There are three types here: 1. Congestive heart failure is by far the most frequent type in the South. In emergency operations necessary to save life there is little time to improve conditions. Such operations include chiefly septic states, obstruction, trauma and hemorrhage. One wonders sometimes if all emergency operations are properly so classified, and if nature and disease are in as great a hurry as the surgical atmospheric intimates. Sometimes deliberate preparation is a good pavement for recovery. Digitalis by mouth, rectum or subcutaneously, in order of decreasing preference, is indicated. Morphia is the second best help. In event of the emergency of grave heart failure without shock, strophanthin (ouabain) intravenously may be used if digitalis has not recently been given. 2. In most operations, the relief of congestion is indicated with digitalis, rest in bed, restricted fluids and salt, and salyrgan (merbaphen) to eliminate edema. Such patients relieved of congestion stand operation well. One can mark time here. 3. In advanced congestive failure with little response to treatment, operation is of grave import and the gain from operation is to be balanced sharply against the cardiac danger. The unexpected mortality with operation here may reach 17 per cent. Such cases without surgery are in frequent danger and may not live over one or two years.

Essential hypertension with little or no enlargement of the heart and good or fair tolerance to exercise makes a good operative risk. The vigorous circulation of hypertension may

be an added factor of safety and the hypertensive heart of tolerance is a good heart until signs of failure or anginal attacks. The loss of blood incident to the operation may actually help the heart. In malignant hypertension with death at best two or three years away, the danger from surgery is often grave. Urgent need to save life would warrant major surgery. The height of the blood pressure here seems not so important as the response of the heart, the condition of the arteries and the kidneys. The ophthalmoscope may read the arterial writing on the retinal wall. Hypotension is unimportant if the heart is good and if not a symptom of shock. If below 100 mm. in old people, one would be careful. With peripheral sclerosis and a good heart, good kidneys and normal or moderate rise in blood pressure, the circulation stands operation well. Nephritis with heart disease doubles or triples the mortality with heart disease alone. Coronary artery sclerosis without angina is probably the most overlooked disease of the circulation after 50. It causes myocardial damage, decreased tolerance, and prognostic changes in the electrocardiogram with T-wave negativity and abberrant QRS. The angina of effort is usually etiologically related to coronary sclerosis. The surgical mortality or the unexpected deaths, as Levine calls them, is increased from 5 to 10 per cent above the normal. There is likewise an increased possibility of coronary thrombosis during or after surgery. I have seen one instance of coronary thrombosis in a man of 65 on the operating table. Coronary thrombosis alone involving the larger branches carries a mortality of near 50 per cent. With operations in a known series of 20 cases there was a surgical mortality of 44.5 per cent.

The inflammatory heart is usually a warning against operation, though Robey of Boston has had tonsillectomy successfully done on children with acute rheumatic fever. The inflammatory heart includes the rheumatic heart, syphilitic aortitis, pericarditis and subacute bacterial endocarditis.

Patients with valvular heart disease without failure stand operation well, as do patients with auricular fibrillation, auricular flutter or heart block if without failure or convulsions. Auricular fibrillation under the influence of digitalis, results in a reduction of the pulse rate to 80 or below and the pulse deficit to zero or near it. There is a difference of opinion

as to whether digitalis should be used in auricular fibrillation associated with hyperthyroidism as a preoperative measure. Paroxysmal tachycardia is no bar to operation though one would avoid operation during a paroxysm if possible. Patients with serious heart disease are intolerant of sepsis and exhaustion. Postoperative pneumonia, septic wounds and crises after thyroidectomy tend to weaken the heart muscle. Postoperative respiratory infections from the common cold to a pneumonia may seriously embarrass the heart. Old people with weak hearts too often succumb to pneumonia even when apparently safely convalescent. Persons with mitral stenosis and the obese seem more prone to embolism. The elderly have the gradual obliteration of much of the right coronary artery and the right heart may yield quickly. A slight degree of cyanosis or distention of the external jugular veins is an untoward sign. The operative mortality with heart disease approximates 5 to 10 per cent above the normal. The lesser figure is probably more nearly correct. With cardiac patients in extreme danger and apt to go at any time or to live not more than one or two years, the burden of proof is upon the surgeon to show that operation outweighs the wisdom of less severe and more purely palliative medical treatment. Good examples of cardiac patients who live precariously are those afflicted with ventricular tachycardia, cardiac asthma, acute edema of the lungs, late aneurysm, gallop rhythm with dilated heart, alternating pulse, extreme emphysema, anginal states or the Adams-Stokes syndrome with unconsciousness or convulsions.

The surgeon contributes much to the safety of the heart during and after operation. "Be sure you are right, and then go ahead" makes for prudence. To be sure that the patient is well prepared for operation promises well for the circulation. The surgeon hasty to operate may remember that lack of preparation may lessen safety, increase postoperative pain and shock, and prolong convalescence. One need not waste time, but one can well afford to take his time except in true emergencies. Each one of us is apt to take our opinion too seriously. "Each viewpoint is important but not paramount." Those surgical clinics with internists and laboratories seem to have the lower mortality. The surgeon thinks primarily in terms of anatomy, mechanics, organ repair or removal, instru-

ments and precision; and the internist in terms of physiology, function, chemistry, the nervous system and psychology. We need closer teamwork, more mutual trust, faith and cooperation, less dogmatism and a more sincere effort to see the other's point of view. If the annual physical examination is good for the individual, how much more necessary is a thorough study necessary for the candidate for operation. The urologist struggling to do a prostatectomy in an old man, and the old man struggling with a senile, second-rate, timeworn circulation, infection of the urinary tract and impairment of renal function, may well welcome and invite the cooperation of an internist. The Cincinnati General Hospital requires an electrocardiogram in such cases.

The hasty surgeon and the dogmatic internist are not warm suitors of clinical judgment. Preparation may remedy what the examination reveals. A strong man does not sleep well the first night in a new bed. A few days in the hospital, a harmless sedative at bed-time, familiarity with immediate surroundings, progressive muscular relaxation, a feeling that details are important and finishing touches count, food and faith, sleep and peace,—these are the chief aids to patient, internist and surgeon. Too many patients enter the hospital the night before or the day of operation. A patient on the operating table has his limitations. To find something in the abdomen to account for the symptoms is important, but an ensemble is also important. Supposed imitation of the gifted and the genius may be in the end but a crude copy. There is a sense of fitness and of relation in the leaders of the art that filters rapidly and often with precipitation. To remove tonsils and hemorrhoids at one operation is to play both ends against the middle and the middle against safety. If one operates for pus, one should be content with pus. To do too much to the patient is also to look too wise if he dies. Silence and regret form a helpless union. The thorough surgeon who does all the operations he can while the patient is under the anesthetic is not to be compared to the conservative surgeon who finishes well the immediate operation he gave himself to do. There are other times and places even in surgery.

The loss of blood is a factor related to the circulation and particularly to shock. The chief duty of a sponge is to absorb, and it does its duty well. Several hundred cubic centi-

meters of blood may be lost with but little apparent loss. Here too is the problem of tissue damage from operative trauma. Hurry, the long handling or even mishandling and manhandling of the abdominal and thoracic organs are invitations to shock and the impairment of the circulation characteristic of that condition. "When other adverse influences are at work," ether favors the development of shock, but nitrous oxide-oxygen and ethylene-oxygen do not. Emergency operations that necessitate much handling of organs like perforations and obstructions may thus be done without ether. The tissues have no reserve oxygen to draw upon. To inspire and to hold one's breath 40 to 50 seconds is a rough measure of the functionally capable heart and yet this brief time largely exhausts the tissue oxygen. A pregnant woman in the third trimester may hold her nose only 25 to 30 seconds. In anesthesia the respiratory center is less sentitive, the carbon dioxide and the hydrogen ion concentration increase in the arterial blood and consequently the alkali reserve decreases. There is danger of anoxemia and probably a slight degree of anoxemia does develop in difficult anesthesia. In general, the more anoxemia the more damage to the central nervous system, and such damage may occur quickly because the blood goes through the brain and cord abundantly and rapidly. The heart is rarely responsible for disturbances of respiration during anesthesia.

Local anesthesia seems to have no effect upon the heart. Epinephrine should be omitted from a local anesthetic for anginal patients in whom it may precipitate an attack and in patients with coronary thrombosis in whom it may add to the danger of rupture of the infarcted area. In anesthesia from volatile drugs the selection of the anesthetist is of far more importance to the circulation and to the surgeon than the selection of the anesthetic. We demand from the anesthetist a smooth sleep for the patient and not a good long fight. It is relaxation rather than struggle that is desired. Chloroform by the open method has lost its vogue though even cardiac patients take it well. I have given it gently in the agony of coronary thrombosis. Ethylene causes less mucus, less struggle, less cyanosis and vomiting, no rise in rate or blood pressure, a smooth sleep and a three-minute recovery. Bevan reports 27,000 ethylene anesthesias without a death or an explosion. Nitrous oxide-oxygen seems second choice, but the Mayo

Clinic records 120,000 ether anesthesias with only one death due to the anesthetic. With proper preparation and in competent hands a reasonable anesthesia alone is not a burden to the heart and circulation.

During anesthesia and the operation premature contractions, sinus arrhythmia, tachycardia, fibrillation or flutter or even transient block may develop. They are not necessarily serious and their treatment may be deferred to the postoperative period, when they may have disappeared. Tachycardia may be due to nervous excitement and we expect a little tachycardia and perhaps cyanosis in the first stage of an anesthetic. Probably 90 per cent of all arrhythmias is due to premature contractions and during operation they are unimportant. Disregarding the first stage of anesthesia and with a competent anesthetist, one may feel that an anesthetic that does not disturb the rate and rhythm of the heart, causes no notable changes in the blood pressure, avoids cyanosis, and does not precipitate venous distention, is a safe anesthetic. On the other hand, if either during the anesthetic or in the postoperative period, a rising pulse rate, particularly above 100, associated with a falling diastolic pressure, particularly below 80 and with a pulse pressure approaching 20, and lasting 30 minutes, with pallor and thready pulse, there is shock. The heart is not responsible for shock. Neither does shock mean heart failure. It is rather an involvement of the peripheral circulation. Digitalis is useless because the action of the heart represents *the result of the failure in the periphery.* In shock the heart has relatively no blood to pump and no peripheral resistance to pump against. The treatment, therefore, is primarily to raise the peripheral resistance by increasing the tonus and the content of the peripheral vessels. Blood transfusion, Horsley's Ringer's solution with glucose given to 3,000 c.c., epinephrine and other well-known measures are indicated. On the other hand, heart failure in the absence of shock, demands digitalis and the usual aids. The carbon dioxide aeration after anesthesia serves the three useful purposes of stimulating the respiratory center, eliminating the anesthetic and preventing atelectasis. It is a hyperventilation that opens the alveoli and quickly relieves and soothes the circulation for the postoperative period.

And yet—and there is always an "and yet" to the art of medicine, for it is a frail art and life is so easy to lose and tragedy comes so quickly. Even with careful preoperative study, ideal anesthesia and surgery, death may occur with an apparently normal heart and circulatory system. It seems to come to the young and healthy during operation as well as to the old and worn. As Sprague says, "Unexpected death on the operating table is, in our experience, more common in young people without heart disease than in old people with it." Twenty such deaths occurred in his hospital in five years and fifteen of the patients were 40 years or younger. Ten of these came to autopsy, and no adequate cause of death was found. One may say that the totality of every surgical procedure is a matter of judgment, with a chance factor common to the art. Judgment is necessary, rather it is imperative. When one has done his best, there is no blame. In such tragedies the occasion was instant, experience fallacious and judgment not only difficult but false. Judgment is knowledge tempered by experience, foresight and common sense. And now abide knowledge, experience and judgment, and the greatest of these is judgment.

Surgery has bestowed upon the world as great boons as science has been able to win for the physical life of mankind. There are four of these and a fifth is in the making. The advances of modern surgery, its technical efficiency and wide accomplishments follow in the train and development of these saving boons. The first of these was introduced by Crawford W. Long and involves the development of volatile anesthesia. The second illustrates the life of Lord Lister and involves the development of asepsis. The third is illustrated by the lives of Kocher and Halstead and involves the delicate art of handling tissues, the saving of blood, the prevention of shock and the perfect healing of wounds. The fourth is illustrated by the life of Crile and involves the discovery of the psychology of fear in surgery and the blocking of shock by local and general anesthesia. The fifth is spreading from the larger clinics and centers to the smaller and finally to the single surgeon wherever he may work. It involves the careful clinical history and examination which we internists call the study of the patient, that he may be prepared and made safe for surgery. Only in this way can there be attained and applied the full knowledge of the relation of the heart to surgery.

BIBLIOGRAPHY

1. Mayo, W. J.: The Value of Imponderables in Clinical Medicine, Proc. Staff Meetings, Mayo Clinic *8:* 675 (Nov. 8) 1933.
2. Dublin, L. I.: The Increase of Heart Diseases in the United States, Presse Med. *42:* 13 (Jan. 3) 1934.
3. Bigelow, S. H., and Lombard, H. L.: Chronic Rheumatism in Massachusetts, New England J. Med. *203:* 1232 (Dec. 8) 1930.
4. Bartholomew, R. A.: Personal communication to the author.
5. McCord, J. R.: Personal communication to the author.
6. Carr, F. B., and Hamilton, B. E.: Five Hundred Women with Serious Heart Disease Followed Through Pregnancy and Delivery, Am. J. Obst. & Gyn. *26:* 824 (Dec.) 1933.
7. Laws, C. L.: The Etiology of Heart Disease in Whites and Negroes in Tennesse, Am. Heart J. *8:* 608 (June) 1933.
8. White, P. D.: Heart Disease, p. 444. New York: The Macmillan Co., 1931.
9. Lewis, Thomas: Diseases of the Heart, p. 271. New York: The Macmillan Co., 1933.
10. Sprague, H. B.: The Heart in Surgery: Analysis of Results of Surgery on Cardiac Patients During Past Ten Years at the Massachusetts General Hospital, Surg., Gyn. & Obst. *49:* 54 (July) 1929.
11. Marvin, H. M.: The Heart During Anesthesia and Operative Proceedings, New England J. Med. *199:* 547 (Sept.) 1928.

    Marvin, H. M., and Pastor, R. B.: The Electrocardiogram and Blood Pressure During Surgical Operation and Convalescence, Arch. Int. Med. *35:* 768 (June) 1925.

    Marvin, H. M.; Pastor R. B., and Carmichael, M.: Effect of Routine Preoperative Digitalization, Arch. Int. Med. *35:* 782 (June) 1925.
12. Blackford, J. M.; Willius, F. A., and Haines, S. F.: Operative Risk in Cardiac Disease, J. A. M. A. *69:* 2011 (Dec. 15) 1917.
13. Butler, S.; Feeney, N., and Levine, S. A.: The Patient with Heart Disease as a Surgical Risk, J. A. M. A. *95:* 85 (July 12) 1930.

    Lennox, W. C.; Groves, R. C., and Levine, S. A.: An Electrocardiographic Study of Fifty Patients During Operation, Arch. Int. Med. *30:* 57, 1922.

    Levine, S. A.: Acute Cardiac Upsets Occurring During or Following Surgical Operation; Their Mechanism and Management, J. A. M. A. *75:* 795 (Sept. 18) 1920.
14. Rountree, C.: Operative Surgery of the Aged, Clin. J. *60:* 257, 1931.
15. McCrae, Thomas: The Circulation in Relation to Surgery, Med. Clinics N. America *10:* 1501 (May) 1927.
16. Robey, W. H.: Treatment of Rheumatic Heart Disease, New England J. Med. *207:* 533 (Sept. 22) 1932.
17. Bevan, A. D.: The Present Status of the Anesthesia Problem, J. A. M. A. *97:* 1530 (Nov. 21) 1931.
18. McQuiston, J. S., and Allen, E. V.: The Relationship of Arterial Hypertension to Surgical Risk, Am. J. Surg. *21:* 72 (July) 1933.
19. O'Hare, J. P., and Hoyt, L.: Surgery in Nephritic and Hypertensive Patients, New England J. Med. *200:* 1292 (June 20) 1929.
20. Phelps, A. E.: Recognition and Management of the Cardiovascular Surgical Risk, J. A. M. A. *86:* 1824, 1926.
21. Smith, L. G.: The Circulation as a Factor in Prostatic Surgery, J. A. M. A. *89:* 925, 1927.

GRITTI-STOKES AMPUTATION FOR GANGRENE OF THE LEG

J. W. Snyder, M. D., F. A. C. S.
Miami

GANGRENE of an extremity is an acknowledgment of our failure in preventive therapy and acceptance of defeat in the preservation of function. Before considering the results of such failure may we briefly review the various conditions which may be productive of gangrene in an extremity. Two distinct groups are readily recognized: the vasospastic type and the obstructive type.

Raynaud's disease is the chief representative of the vasospastic group. Its lesions are usually symmetrical. It is a disease almost exclusively of young women. It is of varying intensity with complete recovery between attacks. The attacks are precipitated both by cold and emotional disturbances. Trophic changes or gangrene are confined largely to the tips of the digits seldom deeper than the skin. The more severe forms with persistent progressive changes indicate obstruction in the terminal arterioles. Examination of the extremity demonstrates full pulsation in all the major arteries. Since gangrene is so limited, a major amputation is never necessary. The more severe cases are cured by a surgical attack on the sympathetic nervous system.

A careful history and physical examination, including all necessary laboratory tests, are essential, particularly in the obstructive type of vascular disease. The sequence of symptoms is frequently diagnostic. With reduction in the blood supply to the distal parts from vascular obstruction, fatigue and pain on exercise become evident and coldness of the extremity will appear. Blanching on elevation with cyanosis on permitting the leg to hang downward are evidences of circulatory embarrassment. Claudication is pathognomonic. A gradually increasing disability in the amount of exercise possible before the onset of pain indicates progression of the obstructive process. Gangrene of the tissue en masse presupposes an obstructive lesion of the arteries.

Read before the Sixth Annual Assembly of The Southeastern Surgical Congress in Jacksonville, March 11, 12 and 13, 1935.

Occlusive vascular disease may be considered in three classes:

1. Thrombo-angiitis obliterans or Buerger's disease,
2. Peripheral arterial sclerosis including diabetic and senile gangrene, and
3. Arterial embolism and thrombosis.

Buerger's description of gangrene as it occurred among the Jews has clarified our conception of thrombo-angiitis obliterans and distinguished it from other forms of vascular disease. We now know that it is found among all races and that it is predominantly a disease of the male. It occurs in youth or middle age and is not a part of the degenerative changes of senility. The process may be acute, subacute, chronic or relapsing, producing thrombosis of the vessels affected. Recurrent superficial phlebitis should arouse suspicion and indicate the existence of trouble before more extreme damage has occurred. The inflammatory process particularly affects the intima with the deposition of a soft red thrombus which is finally converted into dense white tissue. In the final process the artery, vein, and nerve may be intimately incorporated into one inflammatory mass.

The cause of Buerger's disease is unknown, although tobacco particularly in the form of cigarettes is considered an important factor. The possibility of an infectious origin can not be dismissed, as Buerger has reproduced the disease in man by the implantation of a resected segment of an involved vein. The type of disease varies from a very mild one with a long history of claudication to the acutely progressive type with excessive pain and early gangrene.

The most important advance in therapy has resulted from early diagnosis and the prevention of trophic lesions or gangrene. Here protective measures are most important. Avoidance of trauma and protection from cold, are vital. Recognition by the patient of his diminished circulatory efficiency and the regulation of his activities may delay or prevent serious trouble. Fortunately the picture is not entirely that of occlusion. Vasospastic phenomena are also evident in many cases and therapeutic attempts are mainly directed to relax the spastic state of the vessels and permit a more adequate circulation. Although thrombotic occlusion of the artery can not be removed, if an increased blood flow to the part can be obtained by relaxing the vasospasm, we may hope for the

establishment of a collateral circulation in time sufficient to care for the extremity and avoid necrosis. Many measures are employed to improve the circulation. Buerger's postural exercises are useful. Induced fever is probably the most effective method of securing vasorelaxation.

In certain carefully selected cases of Buerger's disease demonstrating excessive vasospasm, sympathetic ganglionectomy has proven effective. The extent of relief to be expected can be determined before operation by estimating the degree of vasoconstriction present. The most effective measures employed to inhibit vasospasm are induced fever and anesthesia, either regional, spinal or general. It is interesting to observe the general change in the appearance of an extremity under anesthesia as well as the change in temperature which may be evident to the touch. More accurate instrumental determinations of the surface temperature are, of course, advisable. Brown states that, if under fever therapy it is found that the increase of surface temperature of the affected part is two or more times that of the mouth, it is safe to assume that an abnormal degree of vasoconstriction is present.

The selection of the patient, himself, should be carefully made as to age, general physical condition and type of process present. If ulceration or gangrene is present, preliminary medical treatment should be administered until the pain is relieved and the ulcer healed. The acute fulminating type should be avoided and preference be given to the stationary or chronic, slowly progressing disease. Within these limitations, sympathetic ganglionectomy will greatly diminish or obviate the possibility of final gangrene.

Arterial sclerosis is a generalized process occurring in the aged. We are all familiar with the pathologic picture of pipe stem vessels with calcification in their walls. The stream bed is narrowed and the volume of flow diminished. Degenerative changes in the intima predispose to the development of thrombosis in the arterioles and with the blood supply already at a minimum but little thrombotic interference is needed to induce serious disturbances or gangrene. Diabetes produces an early arteriosclerosis with the rapidity of atheromatous change greatly intensified resulting in early trophic changes and showing an increased tendency toward infection. The arteriosclerosis of diabetes develops according to Joslin in the arteriosclerotic era of life which for the dia-

betic is after he has had the disease 5 or more years. Gangrene is frequently of the moist type and tends to follow a rapidly progressive course, quite at variance with the relatively benign type of dry gangrene seen in senility.

The symptoms of arteriosclerosis are due to vascular obstruction. As in Buerger's disease the effects produced are claudication, coldness of the extremity and trophic changes. The vessels do not pulsate and with the advent of gangrene, pain becomes intense. Collateral circulation develops with difficulty in the senile and the outlook in general is far less promising than among the younger patients with Buerger's disease. Vasospasm is present to only a minor degree and treatment is difficult. If recognized early every care should be provided to prevent injury to the extremity. Attempts to increase the blood supply are made with caution, because of the thin delicate skin of the senile patient. Mild heat and postural exercises are of some assistance. Alcoholic drinks may be allowed in moderation. Intravenous hypertonic salt solution may be employed. Both sympathectomy and induced fever are contraindicated because of the risk involved and the relative absence of vasospasm. Diabetes, itself, should be accurately controlled and if favorable response is not noted in a relatively short period amputation will be necessary.

The usual precipitating factor leading to gangrene in arterial disease of an extremity is thrombosis, infection or both. Although the arterial circulation may be deficient for a long time without gangrene, if a thrombus forms with obstruction of one or more important channels, gangrene may then rapidly follow. With damage of the intima, thrombosis may occur in any type of arterial disease. If collateral circulation is adequate, gangrene may be prevented, even with obstruction of a major artery, but if inadequate or in the presence of definite vasospasm, the viability of the extremity is threatened.

Embolism produces the same clinical picture except that it is sudden in onset, accompanied by pain with a striking change in color, coldness of the part and disappearance of arterial pulsation. The embolus may arise from a thrombus in a larger artery or from the heart, itself. The embolus may be large, blocking a major artery, or showers of minute emboli may occur. The diagnosis is usually not difficult if

the history and clinical findings are correlated. If the symptoms occur more gradually over a period of time without an acute onset, then thrombus is more probable than embolus. The removal of an obstructing embolus from a vessel has been successfully carried out in numerous instances, the important consideration being accurate localization and early operation. In Key's series of 135 cases operated upon within 10 hours, one-third had permanently good results. If this is not done, conservative treatment with absolute rest and gentle heat should be employed until it is determined whether the collateral circulation will dilate sufficiently to preserve the viability of the extremity.

Recently a method of passive vascular exercise has been employed by Herrmann and Reid which promises to aid materially in the development of collateral circulation in vascular obstructive disease. They have developed an apparatus consisting of a glass boot in which rhythmic changes of positive and negative pressure are produced. The negative pressure tends to dilate the superficial vessels and the positive pressure aids in their emptying. In a series of 75 patients they report 44 per cent completely relieved of their major symptoms, 40 per cent greatly improved and only 16 per cent going on to amputation.

If because of lack of medical supervision or in spite of it, gangrene develops in an extremity, we must then decide whether such gangrene demands amputation, and if so, what type of amputation should be done. In medical literature there is a striking lack of uniformity on this point, and no accurate clinical method for selecting the site of amputation in a given case.

The greatest controversy arises in thrombo-angiitis obliterans. Here the vascular involvement may be patchy with essentially normal vessels above and obstructed vessels below. Allen and Brown report that in 5 per cent of the cases of Buerger's disease seen at the Mayo Clinic, the pulsation of the dorsalis pedis and the posterior tibial arteries was normal. They report several cases of this sort with amputation of the toes alone with normal healing.

In other cases with absent pulsation in the major vessels of the foot and leg and with gangrene present, the question arises particularly in a young individual, whether the am-

putation should be done below or above the knee joint. Meyerding reports 45 cases in which amputation was performed below the knee, in which healing occurred by primary intention in 28, delayed in 8, and absent in 9. In the latter, higher amputation was necessary. He feels that the extent of gangrene is not significant unless it approaches the knee, nor does the duration of the disease have particular importance. In general, if the patient is past middle age, amputation is more safely performed above the knee. He believes that patency of the femoral artery should be given greater consideration than the popliteal artery in making a decision and that the general condition of the tissues at the site of amputation is important. In contrast to this conservative attitude, many men feel that the only safe amputation is one through the middle of the thigh, and this attitude apparently is generally accepted by most authors.

Senile gangrene tends to be relatively benign, of a dry desiccating type and very slowly progressive. If amputation becomes necessary, most men agree, that a high amputation is indicated by reason of the extensive arteriosclerotic process present. In this as in other types of vascular disease, pain due to ischemic neuritis which is constant and intolerable to the patient and scarcely amenable to narcotics, may be the deciding factor in recommending amputation.

In diabetic gangrene, the Mayo group state that one should "either operate early and operate high or treat the lesion medically and avoid all surgery. Attempts to save the feet by amputation of the toes, by open drainage and by other procedures are unquestionably hazardous. Once amputation is decided upon it may be done below the knee, provided pulsation is good in the popliteal artery: above the knee, if pulsation is inadequate." In many cases a gangrenous toe will desiccate and amputate itself at which time it may be readily removed from the living tissue. All attempts at removing gangrenous toes, open up avenues for infection. When infection is present and clearly advancing, high amputation is desirable and should be done without delay. A thick Ochsner dressing of 50 per cent alcohol in boric solution occasionally causes regression of the infection, but amputation should be carried out, if results are not obtained in twenty-four hours.

Embolism needs little comment. The obstruction is usually at the branching of one of the major arteries, and consid-

erably higher than the extent of the gangrene would seem to indicate. Here particularly study of the circulation is indicated. If the gangrene extends as far as the ankle, high amputation is desirable. An interesting comment on amputation by Kirk is as follows: "The real test of the circulation is the use of no tourniquet when the operation is begun, and if normal bleeding is not found, beginning at the selected site, successive higher levels are selected until normal bleeding is encountered. Healing even then will be poor."

In all types of gangrene, close cooperation of the internist and the surgeon are necessary. Proper preparation of the patient is vital and following operation, the internist is far more valuable to the patient than the surgeon. Many of the patients are in severe jeopardy before the development of gangrene, by reason of cardiovascular degeneration, senility or diabetes, and except for the actual operative procedure, the surgeon should rightfully occupy a secondary place in the management of the case.

Sometime past, when I first faced the necessity of doing an amputation for gangrene of the leg, the question presented itself as to how and where the amputation should be done. It was well known that a high amputation was rarely, if ever, end-bearing and seldom entirely satisfactory to the patient. In fitting an artificial leg to an amputated thigh the weight of the body is carried on the ischium and not on the end of the stump. A painless end-bearing stump in contrast permits the patient to get about with much greater comfort and with a minimum of disability. English surgeons stress this point more than is customary in America. It was with the hope of giving this young man a really serviceable stump that a mid-thigh amputation was discarded in favor of the Gritti-Stokes amputation.

This amputation is essentially a disarticulation at the knee joint. The operation is carried out by forming a U-shaped anterior flap the angles of which are just above the condyles of the femur and the lower border over the patellar ligament. This is deepened and the patellar ligament is divided. A posterior flap about one third the length of the anterior flap is then marked out. The knee is flexed and the joint opened. It is then disarticulated by dividing the hamstring tendons and the popliteal structures. The structures are retracted and

the femur is sawed through just above the condyles at right angles to the thigh. The patella is grasped and its articular surface is removed with a thin-bladed saw. To complete the operation all vessels are ligated, the sciatic nerve is ligated and injected with alcohol, and the patellar tendon is then sutured to the periosteum on the back of the femur to fix the patella in position. The skin flaps are approximated by interrupted suture with drainage at the angles. This procedure if successful will give an excellent end-bearing stump with the scar well posterior and away from possible trauma.

Report of Cases

My first patient was a man 30 years of age who was suddenly seized with an excruciating pain in the left leg followed by gangrene of the foot and calf. A diagnosis of embolic circulatory obstruction was made. As the gangrene became definite and was associated with considerable fever and toxemia, amputation was advised.

The gangrene extended up posteriorly to the middle of the calf but the skin anteriorly seemed normal almost to the ankle. The popliteal vessels were palpable and some pulsation was thought to be found but this was not definite. A Gritti-Stokes type of amputation was carried out under ether anesthesia. Flaps were outlined and the condyles of the femur removed. The popliteal vessels were found thrombosed and on removing a tourniquet from the thigh no bleeding from the stump occurred. By this time the patient's condition was precarious: pulse was 150. While an amputation at the middle of the thigh was considered, the risk was too great to warrant further surgery at the time.

Much to our surprise the expected necrosis of the stump did not follow, although there was an apparent absence of circulation. A small amount of sloughing occurred but in the main the wound healed exceptionally well and secondary thigh amputation was avoided. This outcome was so at variance with what I expected that I had the courage to employ this operation in subsequent cases of a similar character, a total of seven cases in all with complete satisfaction.

My second patient was a man of 68 years, with an alcoholic history and serious myocardial damage. He exhibited a senile type of gangrene which had progressed for a period of two weeks. Blebs covered the lower two-thirds of the leg and the foot was definitely gangrenous. Spinal anesthesia was employed which seemed to diminish the amount of shock. At operation bleeding was noted from the stump of the femur and from a few points in the soft tissues although the popliteal vessels were thrombosed. The actual bleeding was estimated at 10 per cent of normal. This stump healed by primary union in a satisfactory manner.

The third patient was a moderately obese woman 65 years of age. Polyuria had been present for some years and recently she had exhibited evidence of dementia. Diabetes was diagnosed five months before admission to the hospital. At the time of admission this patient showed hypertensive heart disease with auricular fibrillation, and the right foot was black. A line of de-

marcation was seen at the ankle with some dark areas above this point. There was also an area of necrosis on the left heel. Amputation was done under spinal anesthesia. The popliteal vessels were thrombosed and the evidences of circulation were slight but again healing occurred in a very satisfactory manner. Five years later the stump was in good condition.

A fourth case of arteriosclerotic gangrene was that of an old man who was admitted in a very toxic state. He had experienced two previous cerebral hemorrhages. His cardiac function was markedly impaired and his white count was 45,000 with 88 per cent neutrophils. There was gangrene of the left leg with a line of demarcation just below the knee. Because the line of gangrene approached so very near to the point of amputation I was doubtful as to the success of healing. The popliteal vessels were thrombosed and the bleeding slight but again healing occurred satisfactorily.

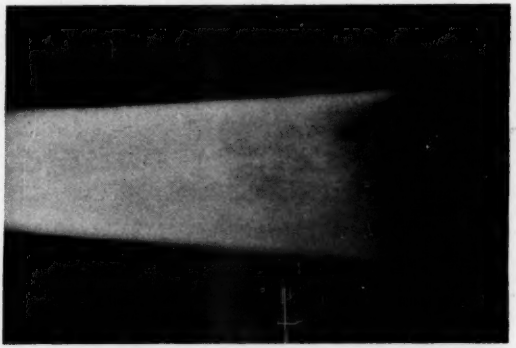
A fifth case was one of diabetic gangrene in a woman, aged 44. It was unusual in that both legs were gangrenous to the middle of the calf, and it was complicated by carcinoma of the cervix. Under medical management the glycosuria was controlled and a double Gritti-Stokes amputation under spinal anesthesia was carried out with little evidence of shock. Again in spite of the picture of almost bloodless stumps, healing occurred promptly with no serious loss of tissue. Before she left the hospital, radium was applied to the cervix. Death occurred some two years later from the cancer, but the stumps remained in good condition.

A sixth patient was a man, aged 53, who gave a history of diabetes of 18 years' duration. Fifteen years previously two toes had been removed for diabetic gangrene with successful healing. During the 18 years he had been on a diet most of the time and he had been taking insulin for the past three years. Eight months previously he had noticed a discoloration of the toes and pain in the foot. His heart had been irregular for a year, with a systolic murmur over the aortic area. After eight months of suffering in bed the patient decided that he was willing to do anything that would rid him of the pain and permit him to get about.

Examination disclosed gangrenous toes with no pulsation of any of the major vessels, including the superficial femoral. At operation the popliteal artery was found occluded by an old, well-organized thrombus. The bleeding encountered was slight. Only one small vessel was ligated and this vessel dripped and did not spurt. In this case, holes were drilled at each angle of the femur and corresponding holes in the distal portion of the patella. Fascia strips secured from the amputated leg were passed through these holes, approximating the patella to the femur. It was felt that this was an ideal procedure, but the extra time necessary to carry it out, would seem to make the procedure inadvisable. The wound has healed slowly but without sloughing of any importance.

The last case is one illustrating what should not be done in diabetic gangrene. The patient was a woman 62 years of age who came into the hospital with an infection of the left foot which had been present for five months, following the paring of a corn. It had healed and broken down repeatedly during that time. Polyuria had been present for a year and a systolic murmur was heard at the apex of the heart. Edema, redness, and ulceration involved the fifth toe, with necrosis of the distal phalanx. Swelling, tenderness

and redness extended to the dorsum of the foot. The blood sugar was 220 mg. and glycosuria was graded 4. Conservative diabetic management for a month effected a return of the blood sugar and urine to normal. The little toe and fifth metatarsal were then removed under ether anesthesia and from that time the condition became rapidly worse. I was first called to see her 17 days later, at which time she presented evidence of cardiac embarrassment: her temperature wac 103, pulse 120, and there was extensive gangrene of the foot. The blood sugar was both high and difficult to control. Because of the



Appearance of the stump four months after a Gritti-Stokes amputation for diabetic gangrene (Case 6).

severe toxemia, it was felt that the patient had no possibility of recovery without amputation, and very little with amputation, but if anything could be done, prompt action was necessary. She went through the operation without the slightest difficulty and the following day her pulse and temperature were normal. The third day, however, she developed heart failure with hypostatic pneumonia, and died the fourth day after operation.

COMMENT

In this series of cases the Gritti-Stokes type of amputation was carried out at first with much concern as to the outcome, but with increasing experience, I began to have more confidence. If we consider that the larger muscle bodies of the thigh are left undisturbed with no incision across their structures and no disturbance of their circulation some reason attends this type of procedure. The nutrient artery to the femur enters at a higher level from the profunda femoris and as division of the femur just above the condyles does not open the marrow cavity of the bone reasonable insurance of the integrity of the femur may be felt. Sloughing of the stumps of the hamstring muscles is of minor importance, the main question is the viability of the flaps and the patella itself.

Apparently the rather free anastomosis about the patella is sufficient to maintain its nutrition and in no case has enough necrosis of the flaps ensued to give concern. In most of these operations the tourniquet has not been applied because of fear of producing damage to the circulation in the thigh. I have never felt it necessary to secure the patella to the femur with screws or nails as the tension of the quadriceps acting against the patella seems to hold the patella firmly against the femur. Secondary reinforcing sutures are however employed. If union of the patella to the femur fails to occur, the stump will not be a success from the mechanical standpoint but this has not happened in our series.

These cases are not presented with the thought that this type of operation will always be a success but the operation is much less severe on the patient than a mid-thigh amputation producing little if any shock when done under a spinal anesthesia. If successful it gives the patient a far more satisfactory stump.

REFERENCES

1. Allen, E. V., and Brown, G. E.: Erroneous Diagnosis of Raynaud's Disease in Obliterative Vascular Disease, Am. J. M. Sc. *174:* 319 (Sept.) 1927.
2. Brown, G. E.: Diseases of the Peripheral Arteries: Classification, Diagnosis and Treatment, Pennsylvania M. J. *36:* (Feb.) 1933.
3. Buerger, Leo: Thromo-angiitis Obliterans: A Study of the Vascular Lesions Leading to Presenile Spontaneous Gangrene, Am. J. M. Sc. *136:* 567, 1908.
4. Buerger, Leo: The Circulatory Disturbances of the Extremities Including Gangrene, Vasomotor and Trophic Disorders. Philadelphia: W. B. Saunders Co., 1924, 628.
5. Burke, C. F., and Meyerding, H. W.: Results in Relation to the Site of Amputation in Thrombo-angiitis Obliterans, Surg. Gynec. & Obst. *53:* 389 (Sept.) 1931.
6. Herrmann, L. G., and Reid, M. R.: Passive Vascular Exercises, Arch. Surg. *29:* 697 (Nov.) 1934.
7. Herrmann, L. G., and Reid, M. R.: The Conservative Treatment of Arteriosclerotic Peripheral Vascular Diseases, Ann. Surg. *100:* 750 (Oct.) 1934.
8. Joslin, E. P.: Treatment of Diabetes, Philadelphia; Lea & Febiger, 1928, pp. 786-787.
9. Key, E.: Die Embolieoperationen auf Grund der bisherigen Erfahrungen, Ergebn. d. Chir. u. Orthop. *22:* 1, 1929.
10. Kirk, N. T., Amputations, Dean Lewis: Practice of Surgery, vol. 3, 7.
11. McClure, W. B., and Aldrich, C. A.: Time Required for Disappearance of Intradermally Injected Salt Solution; Preliminary Report of Observations, with Special Reference to Cases of Edema, J. A. M. A. *81:* 293, 1923.
12. Starr, Isaac, Jr.: Studies on the Circulation of the Feet in Diabetes Mellitus with and without Gangrene, Am. J. M. Sc. *180:* 149 (Aug.) 1930.
13. Walters, W.; Meyerding, H. W.; Judd. E. S., and Wilder, R. M.: Surgery in Diabetes, Minnesota Med. *17:* 517 (Sept.) 1924.

UNUSUAL CANCERS OF THE BREAST

DEAN LEWIS, M. D., F. A. C. S.
and
CHARLES F. GESCHICKTER, M. D.
Baltimore

CURRENT discussions on methods of treatment and curability of cancer of the breast rarely take into account the unusual pathologic types which differ markedly in their clinical behavior from the more common scirrhous and medullary varieties of mammary carcinoma. Moreover an understanding of the relationships of benign conditions of the breast to

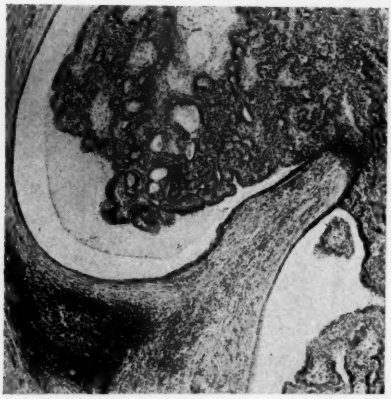


FIG. 1. Photomicrograph of benign intracystic papilloma showing the stalk and encapsulating cyst wall.

these unusual forms of cancer, such as papillary carcinoma, mucoid cancer, comedo carcinoma and Paget's cancer of the nipple permits more accurate prognosis and treatment in the so-called borderline tumors or precancerous lesions.

PAPILLARY CANCER

A serosanguineous discharge from the nipple occurs in 40 per cent of the cases where there is a benign intracystic papilloma of the breast (Fig. 1). The lump may vary in size from a pea to a walnut or may be undetectible by palpation. The

From the Department of Surgery and the Surgical Pathological Laboratory, Johns Hopkins Hospital and University.
Presented by Dr. Lewis before the Fifth Annual Assembly of The Southeastern Surgical Congress, in Nashville, March 6, 7 and 8, 1934.

tendency to regard such a sanguineous discharge from the nipple as an indication of malignancy and to consider that all papillomatous tumors require radical surgery is not warranted by careful analysis of a large series of cases.

Cancer arising in a benign papilloma is a late manifestation occurring in a tumor of appreciable size and is usually accompanied by a change in character of the discharge from the nipple which becomes bright red in color. Despite the fact that pathologic studies relate benign papillomas to papillary cancer, there were no metastases in a group of 180 cases of papilloma treated by simple excision (or rarely a com-

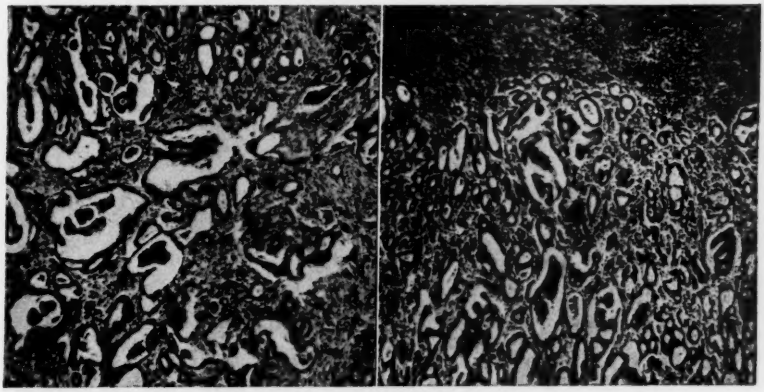


FIG. 2. Papillary carcinoma arising in benign intracystic papilloma. Note the distinct acinar arrangement. The photomicrograph is made from a section removed from the breast tumor.

FIG. 3. Papillary carcinoma metastasizing to the axillary lymph nodes. The photomicrograph was made from a section of the axillary lymph node, from the same case as shown in Fig. 2. Note how the papillary and adenomatous character of the tumor is preserved in the metastasis.

plete operation) on the surgical service of the Johns Hopkins Hospital during the past thirty years.* When in the opinion of the operator the lesion in the gross was benign, the microscopic picture showed the typical branching stalks overlaid by orderly rows of columnar or oval epithelium richly supplied with blood vessels. Invasion of surrounding fibrous tissue beyond the limits of the capsule was not demonstrated in the laboratory in these cases.

Where large papillomas undergo late malignant change the

* One case may be regarded as an exception. This patient had a recurrence following excision of a papillary tumor. The recurrence showed colloid cancer coexisting in the section with papilloma.

clinical evidence is found in the size of the growth, the duration of the symptoms, and the change in the character of the discharge from the nipple. The symptoms in these cases may extend over a period of from five to thirty years. Pathologic examination may disclose a portion of the benign papilloma persisting next the malignant tumor. Microscopic study is the most reliable guide in establishing the papillary origin of the malignant tumor. Strands of malignant epithelial tissue grow in folds or papillary formation. Islands of tumor epithelium giving rise to oval shape acini or small tubule-like structures invade the surrounding breast tissue

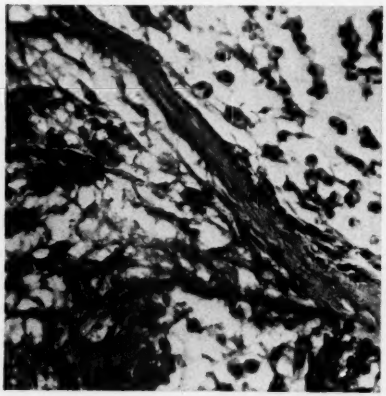


FIG. 4. Photomicrograph showing the character and structure of mucoid carcinoma.

and may be seen even in the instances where metastases occur (Figs. 2 and 3.) In some of the long standing papillomas a variant of the usual type of malignancy may be found in the form of mucoid cancer (so-called colloid cancer of the breast).

A series of 95 papillary carcinomas of the breast could be separated on pathologic and clinical grounds from a total of 2270 carcinomas of the breast recorded in the Surgical Pathological Laboratory. Of 55 patients followed for a sufficient period of time to determine the late result, after a period of five years 34 were living and reported free from the disease. This low degree of malignancy, 61 per cent of five year cures, is evidence in favor of the origin of this form of cancer from pre-existing benign papillomas and warrants their separation from other forms of cancer. Among the cases dying from the disease, four survived a period of from four to six years.

While local excision suffices to cure the benign papilloma which has not grown too large, in the larger papillomas, exceeding the diameter of a 50 cent piece, particularly in women past the age of 40, it is important to have a biopsy made to rule out malignant change. Size and age predispose to malignant change and the size means mutilation of the breast regardless of the type of operation. With any microscopic suspicion of malignancy the complete cancer operation should be performed.

Mucoid, Gelatinous or Colloid Cancer

Colloid cancer occurs in adults past the age of menopause or occasionally a decade sooner. In the majority of 70 cases

Fig. 5. Cross specimen of a recurrent mass of mucoid carcinoma removed by axillary dissection nineteen years after a previous incomplete operation.

studied in this series the duration is in terms of years rather than months. In one case remaining well over four years the tumor had been present 48 years, and it is not rare to find the history dating back 8, 10, or 17 years. Discharge from the nipple occurred in 10 per cent of the cases. The presumption is that mucoid carcinoma follows a type of gelatinous degeneration which occurs in slowly growing papillary cancers which develop upon benign papillomas. In reviewing a large series of papillary cancers, areas of colloid change are not rare and in one case originally operated upon for papilloma, removed by local excision, the papilloma recurred and underwent malignant change with gelatinous cancer co-existing in the section with papilloma.

Microscopically and in the gross the tumor is characteristic. On incision the tumor material often flows from the wound. Under the microscope small rings of cancer cells are separated by a large amount of clear mucoid substance (Fig. 4).

The treatment for colloid carcinoma is the same as for papillary cancer, the complete operation being performed with the probability of 60 to 70 per cent of five year cures. Even when the disease is not eradicated the patient may live

FIG. 6. Photograph of the patient from whom the mass shown in Fig. 5 was excised. The photograph was made 22 years after the primary operation and 3 years following the second operation. The swelling in the region of the clavicle is produced by a second recurrence.

ten or more years with recurrences after long intervals. In this group are patients who have died with metastases, 6, 8, 17 and 35 years after the primary operation. The majority of them however remained well when the complete operation was performed the first time. The long clinical course that this low grade of malignancy may pursue in the breast is illustrated by the following case:

The patient, at the age of 36, in 1896, had her left breast removed for cancer. The pectoralis minor was not removed and part of the axilla was not dissected. Five years later a mass appeared just below the axilla which gradually increased in size. In July, 1915, Dr. Bloodgood operated on the recurrent tumor and did a partial excision of the mass in the apex of the axilla (Fig. 5). He found it impossible to remove all the tumor because of its prox-

imity of the larger nerves and vessels. Following this the patient remained fairly well, but in 1919 a mass appeared in the region of the clavicle. The patient received deep x-ray therapy in 1919 and 1920, and again in 1922. In 1926 an indurated mass developed suggesting a recurrence beneath the clavicle. Further irradiation was given. In April, 1931, Dr. Dandy performed an operation for the relief of pain because of symptoms of nerve pressure in the brachial plexus. At this operation tumor tissue microscopically verified was removed from the nerves. Pain, however, soon recurred with swelling of the arm and lymphedema.

In November, 1931, the arm was amputated. Erysipelas developed in the wound and the patient died, Nov. 21, 1931, thirty-five years after the first operation. At all the operations tumor tissue could be demonstrated in the axilla or supraclavicular regions.

Lee, Hauser and Pack[1] have recently reviewed thirty cases of gelatinous carcinoma of the breast treated at the Memorial Hospital and are impressed by the relatively low degree of malignancy of these tumors. In their experience metastases occur late in the course of the disease and are usually confined to the axillary lymph nodes but are not necessarily of the gelatinous types. They find 57 per cent of five year cures as compared to 41 per cent in the control group.

Comedo Carcinoma

This form of low grade cancer has been described by Bloodgood.[2] These tumors usually form a small or medium-size lump in the breast with or without the accompanying clinical signs of cancer. In late cases the tumor may be fixed to the chest wall or fungate. In spite of such signs of seeming inoperability metastases to the axillary glands are usually not present. In rare instances the entire breast may be involved by multiple nodules suggesting chronic cystic mastitis. In other cases a very large tumor may be present. (Figs. 7, 8, and 9).

In typical comedo carcinoma or duct cancer the axillary lymph nodes are uninvolved and the probabilities of permanent cure following the complete operation are practically 100 per cent. In two cases in this series both breasts were involved, in one case simultaneously and in the other successively, after an interval of three years. Where comedo carcinoma is accompanied by chronic cystic mastitis in the same breast the prognosis is equally as favorable as in the typical form. In another group of cases, duct cancer may be associated with carcinoma of another type and in such in-

stances metastases will occur in the same percentage of cases as is usual with the secondary type.

Three forms of comedo carcinoma are distinguishable under the microscope. In one group of cases the cells of cuboidal character with occasional mitotic figures are confined within a basement membrane filling the lumens of the pre-existing ducts and mammary tubules. These cords of cells make up the entire tumor mass and the ability to express this cellular material from the ducts is responsible for the term comedo

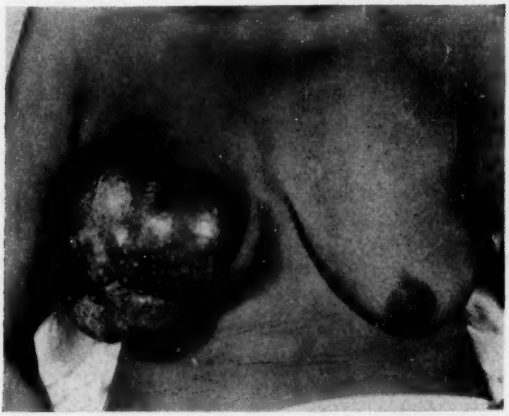


FIG. 7. Photograph of a large fungating comedo carcinoma.

carcinoma. In another series of cases such areas are intermingled with chronic cystic mastitis of the Schimmelbusch type which has been described as adenosis (Fig. 9). In the third group of cases the areas of typical comedo carcinoma are associated with islands of fully developed breast cancer which infiltrate the fat and fibrous tissue. Because of the possible association of fully developed cancer with typical areas of comedo tumor, if the growth is too large to exclude the presence of malignant areas by frozen sections, radical mastectomy should be done.

BENIGN KERATOSES AND PAGET'S CANCER

The original studies of Paget and those of Bloodgood and Kilgore made in this laboratory, as well as the personal investigation of this material, favor the view that Paget's cancer may arise from benign keratoses and that both diseases may

take origin from the nipple zone which harbors the growth center of the mammary buds.

Of 75 cases recorded in this group of nipple lesions 30 were microscopically diagnosed as benign keratoses and 45 as cancer of the Paget type. The disease may appear any time after 35, but the majority of cases occur after the menopause (over 45). The duration of the disease is in terms of years rather than months and the initial symptoms relate to the nipple with

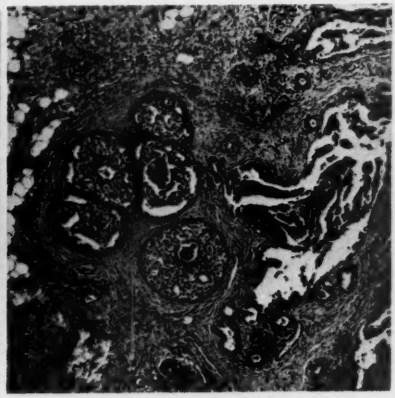


FIG. 8. Photomicrograph of the tumor shown in Fig. 7. Note the typical intraductal arrangement of the tumor cells with areas of central necrosis.

FIG. 9. Areas of comedo carcinoma appearing in the breast, the seat of adenosis or chronic cystic mastitis of the Schimmelbusch type.

crusting, bleeding, retraction or discharge followed after a long interval by a lump in the breast beneath it. After cancer develops in the breast, metastases may appear in the axillary lymph nodes.

The earlier phases of the disease are limited to the nipple which is involved by a benign wart or eczema. The lesion is usually of the squamous cell type and does not involve the ducts beneath. In this stage the disease may be cured by soap and water, and petrolatum, which removes the source of irritation and promotes healing.

Later with involvement of the basal cell layers of the nipple zone, excision of the whole nipple area is necessary and if the large malignant cuboidal cells of the Paget type appear in the section, the complete operation for cancer must be done. These large cuboidal cells appearing in the basal cell layer of the nipple involve the mouths of the larger ducts, and them-

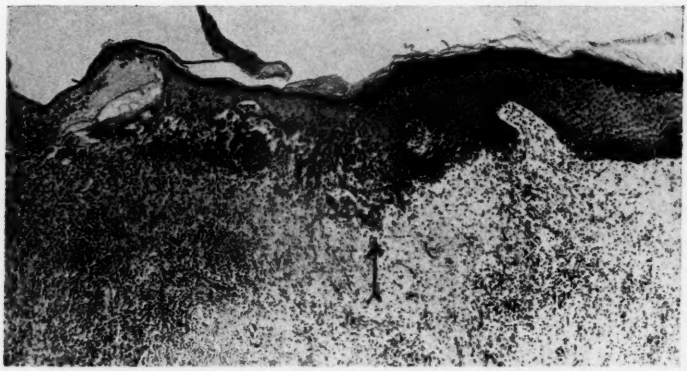


FIG. 10. Photomicrograph of Paget's disease of the nipple. The cells in the lower portion of the epidermis are being replaced by large malignant cancer cells which are finding their way into the subcutaneous tissue in the region of the arrow.

selves may be seen to give rise to ducts of the embryonic type, duplicating the behavior of the mammary bud seen in the embryo. In addition to this activity at the nipple, the large ducts beneath become filled with cells in which the typical cuboidal Paget type predominate. Eventually carcinoma may infiltrate the breast tissue beyond the ducts as does scirrhus cancer (Fig. 10).

In none of the 25 cases diagnosed as benign lesions of the nipple and treated by excision was death recorded from recurrence, although in one case amputation of the breast was performed six months later for malignant change. Where the malignant change had occurred and the breast was involved, cures of over five years duration were established in 5 of 40 cases by doing the radical operation. Twenty per cent of the malignant cases had preoperative or postoperative irradiation in addition to surgery.

In addition to the cases of the primary Paget type described above there is a small group in which the cancer originating in the breast beneath invades the nipple zone by way of the large ducts. These cases of Paget's secondary to carcinoma of the breast have an exceedingly bad prognosis, and are generally accompanied by skin metastases. In rare cases Paget's cancer of the nipple has been observed in males.

REFERENCES

1. Lee, B. J.; H. Hauser and G. T. Pack: Gelatinous Carcinoma of the Breast, Surg., Gynec. & Obst. *59:* 841 (Dec.) 1934.
2. Bloodgood, J. C.: Comedo Carcinoma of the Female Breast, Am. J. Cancer *22:* 842 (Dec.) 1934.

ETHER INTRAPERITONEALLY IN APPENDICEAL ABSCESS

R. B. McKnight, M. D., F. A. C. S.
Charlotte

SOULIGOUX, a French surgeon, in 1892, used ether in cleansing the severely crushed legs of a patient on whom amputation was indicated but was definitely refused. The best reduction possible under the circumstances was done and casts applied. To the surgeon's surprise, the patient developed no infection and recovered. In 1912, he used ether in the peritoneal cavity in a case of general plastic peritonitis following rupture of the cecum. Colostomy was performed and the abdomen drained. Recovery was prompt and uneventful. The next year he reported 36 cases of peritonitis in which ether was used intraperitoneally. There were only two deaths, neither of which could be attributed to the intraperitoneal use of the ether.

Saliba, of Elizabeth City, N. C., made extensive studies on the action of ether in peritonitis and did much to popularize this adjunct to the treatment of this dreaded condition two decades ago. His work received wide attention. De Tarnowsky, in 1914, reported a series of 30 cases of peritoneal infection with no deaths. In the same year, Phelip and Tartois used ether intraperitoneally in 16 cases of peritonitis in children and compared the results with 16 similar cases in which ether was not used. They were enthusiastic over the favorable results. Many German and Italian and a few French and American surgeons have reported on its use in peritonitis and have been almost unanimous in their impressions that it is of distinct value in lowering the mortality, lessening the degree of infection and giving the patient a shorter and smoother convalesence. A few have warned against it in the diseased abdominal cavity, particularly Fantozzi, an Italian surgeon, who in 1920, contended that the hemolytic action was too powerful, it was too weakly antiseptic and induced such intense cold, when the viscera should be kept warm, that its use was not justified. These contentions were based largely

Read before the Sixth Annual Assembly of The Southeastern Surgical Congress, in Jacksonville, March 11, 12 and 13, 1935.

on observations made on laboratory animals. In a subsequent report, however, he admitted that if ether is used for moistening gauze, sponges and packs, beneficial results would be realized. He described 13 cases showing its advantage. Sigwart, in 1922, reported 11 cases of diffuse septic peritonitis with one death occurring 18 days postoperatively from gangrene of the lung. Schleussner, in 1927, reported 113 cases of severe perforation peritonitis in which ether was used in the abdominal cavity. There were 12 deaths, a study of which is convincing that death was inevitable in all and that none could be traced to the use of ether. Corbett, in a study of peritoneal adhesions in 1917, concluded that all the strong antiseptics seemed to do harm in the peritoneal cavity and to intensify peritonitis rather than inhibit it. The only exception was ether, although it is not a strong antiseptic. He referred to the work of Waterhouse in England and Saliba in America, stating that they had established the use of ether in the peritoneal cavity in proper doses. He demonstrated that ether seemed to be the most satisfactory chemical means of combating infection, but that it is not devoid of danger and is not always effective.

As a basis for this paper, 38 cases of appendiceal abscess in which ether was used intraperitoneally are reported. In a series of 250 consecutive primary appendectomies there were 38 appendiceal abscesses with local or moderately general peritonitis, with no deaths; one patient with diffuse general septic peritonitis and a "silent abdomen" died; 118 acute or subacute cases, with one death; 82 chronic cases and 11 normal, each with no deaths. A local colleague, an excellent surgeon, kindly permitted the use of a series of 20 cases of suppurative appendicitis with abscess formation in which ether was not used for comparison. In his series there were three deaths.

Believing that the most favorable time for operation in appendicitis is when the diagnosis is made, all patients diagnosed acute or ruptured appendicitis were operated on as soon after admission to the hospital as possible. Under ether or low-dosage spinal anesthesia the abdomen is opened through a McBurney incision sufficiently wide to allow a reasonably good exposure of the pathologic process present. If pus is not present on opening the peritoneum, the abscess

is localized and evacuated, the pus being removed with sponges and suction. The appendix should be removed if possible, as it is the focus instigating the peritoneal infection. After thoroughly cleansing the abscess cavity of pus, the cavity is flushed out with warm saline solution, sucking it out immediately after introduction. The abdominal wall is then slightly and gently elevated with a small retractor or the assistant's index finger hooked under the peritoneum; ether is then introduced, pouring from 2 to 4 ounces directly into the cavity; after a minute or so it is sucked out and the process repeated several times. The purpose in elevating the abdominal wall is to enable the ether to penetrate the various folds and crevices adjacent to the abscess cavity and to permit the fumes from the bubbling ether to diffuse throughout the abdominal cavity. Little ether is left in except in the form of vapor and that which may trickle away, which rapidly evaporates. One or two penrose drains are introduced, to be removed in twenty-four to forty-eight hours—rarely longer, and the abdomen is closed in the usual manner.

When the ether comes in contact with the tissues they quickly blanch, turning pale pink. This vasoconstrictor action is due to the cold following rapid evaporation. After the ether is sucked out or bubbles away, the tissues assume a rich pink color—definite evidence of an active hyperemia. At this point, particularly in those patients under a general anesthetic, increased motility of the gut is frequently observed. There may be a slight acceleration of the respiratory rate.

When the patient is returned to his bed he is quiet; the usual supportive measures are carried out and body fluids maintained. Convalesence has been, with one exception, entirely uneventful. This patient, a boy of 15, became distended the seventh postoperative day with slight opening of the wound where a small loop of bowel appeared. Enterostomy was done and the wound repaired. He subsequently developed a lung abscess which cleared up under postural drainage. Eventually he recovered and played in the line on a football team the following fall. Another patient remained in the hospital five weeks, one four and two three weeks. With the exception of these five, the longest stay in the hospital was eighteen days and the shortest eight days, with an average of twelve days. Those patients in whom the drains

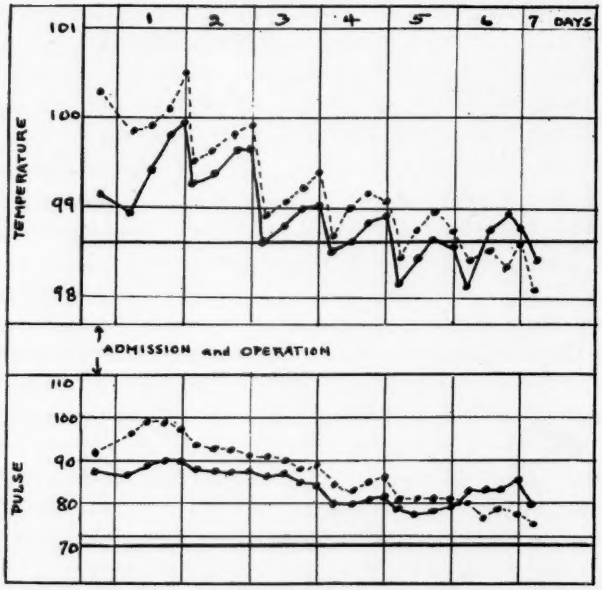


CHART 1. Composite temperature and pulse graphs of 38 cases of appendiceal abscess in which ether was used intraperitoneally (dotted lines) and the whole series of 250 primary appendectomies (unbroken lines). The pulse and temperature curves of each series are practically parallel and each shows a smooth convalescence. The initial temperature in the abscess cases is over a degree higher and the initial pulse rate only slightly faster than those of the whole series.

were removed early, had fewer postoperative hospital days. Practically all of these patients have been followed up and there has been no evidence of peritoneal adhesions.

In studying this series of 38 cases of appendiceal abscess in which ether was poured into the abscess cavity it was deemed advisable to make composite clinical charts of the temperature and pulse rates, believing that this would afford a fairly accurate comparison with the series as a whole (chart 1), the acute uncomplicated cases (chart 2), and the series of ruptured cases in which ether was not used (chart 3); also, that the smooth convalesence following the use of intraperitoneal ether could be demonstrated. It is a bedside observation that these patients as a group were not as sick as one would expect; with only two or three exceptions was there any undue postoperative abdominal distention, the response to the usual methods of inducing intestinal elimination on the

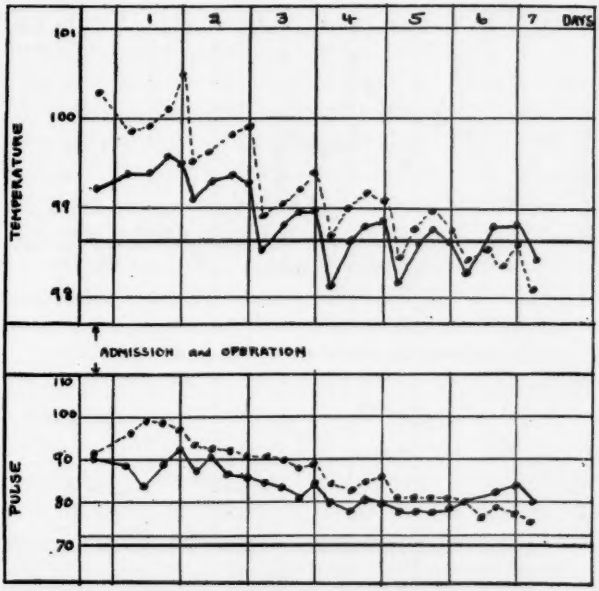


CHART 2. Composite temperature and pulse graphs of 38 cases of appendiceal abscess in which ether was used intraperitoneally (dotted lines) and 30 cases of unruptured acute appendicitis—8 gangrenous—selected at random (unbroken lines). The initial temperature of the uncomplicated acute cases is over a degree lower than that of the abscess cases and the initial pulse is about the same. Contrasted with the graphs of the whole series (Chart 1), the initial temperature of the uncomplicated acute cases is about the same, there is less postoperative temperature rise and the pulse rate drops after operation and does not rise above the initial rate.

second or third postoperative day was entirely normal. Why should this not be done earlier? Finney uses pitressin every four hours after the patient leaves the operating room, and this is supplemented by daily doses of castor oil. He has observed only good results. We do not start intestinal elimination soon enough! The temperature and pulse rate dropped steadily by lysis over a period of three days to approximately normal, and the respiratory rate, which is not charted, showed nothing of significance.

As may be seen in Chart 1, there are no striking differences between the composite temperature and pulse rate curves of 38 cases of appendiceal abscess and the entire series of 250 primary appendectomies. The initial temperature of the former is a little over a degree higher, and the pulse rate about five points faster. Smooth convalesence in each series is per-

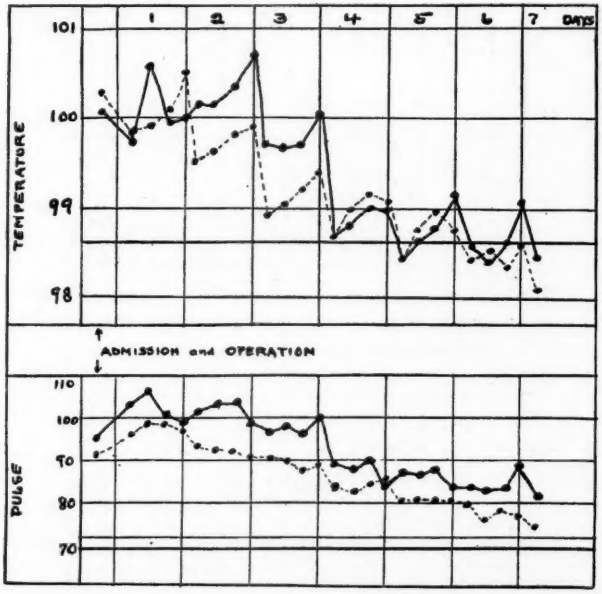


CHART 3. Composite temperature and pulse graphs of 38 cases of appendiceal abscess in which ether was used intraperitoneally (dotted lines) and a series of 20 consecutive cases of appendiceal abscess in which ether was not used intraperitoneally (unbroken lines). In the latter series, furnished through the courtesy of a colleague, there were three deaths. The initial temperature and pulse rate is about the same. The average temperature and pulse rate of the latter series average well above those of the series in which ether was used. There is not the same smooth convalesence especially during the first three postoperative days, when it is rather stormy. After the first three days the temperature is about the same, but the pulse rate is definitely faster where ether was not used intraperitoneally.

fectly obvious. It is interesting to note that both curves of the whole series cross those of the abscess series on the sixth day. This is explained on the basis of several postoperative wound infections occurring in those patients with primary closure.

In Chart 2 is seen the same close parallel between the abscess series and 30 uncomplicated acute cases that existed between the abscess series and the whole series. The initial temperature and pulse rate of the acute cases are but slightly higher than the whole series. The postoperative pulse rate does not exceed that on admission. The terminal high pulse and temperature readings of the patient dying from a primary pneumonia complicated by an acute appendicitis are not recorded. As in Chart 1 the curves cross on the sixth day which is ex-

plained by the development of a few wound infections. These all cleared up rapidly under hot saline stupes.

The graphs are reversed in Chart 3. Those 20 patients with appendiceal abscess in whom ether was not used show a stormier convalesence for the first three days, and the pulse rate especially remains well above that of the ether patients. At the end of the second day the "borrowed series" patients are definitely sicker than those who had ether intraperitoneally. The terminal rise in temperature and pulse rate of those terminating fatally are not recorded. It is perfectly evident from this chart that convalesence is rather stormy and that the higher temperature and pulse curves tend to drop by crisis on the fourth day instead of by a gradual lysis as in the ether series.

Ether is of value in other infections. Its use in traumatic septic arthritis is frequently followed by gratifying results; there is a fairly quick drop in temperature and the infection clears up rapidly. Postoperative superficial infections respond quickly to ether irrigations, just as promptly as they do to hot saline dressings, although the latter may be more comfortable to the patient. If peripheral wounds are thoroughly flushed with ether, primary suture without drainage is usually followed by first intention healing. Beneficial results from introducing ether vapor in the uterine cavity following septic abortion have been observed. As a matter of fact, ether has been used in almost any type of infection even in the pleural cavity in empyema.

The action of ether in combating septic conditions resolves itself into three questions: What effect does it have on the invading organism? How does it assist vital resistance, or aid nature's defenses against infection? And, in the case of peritonitis, what action does it have, if any, on motility of the bowel?

Ether does have some limited bactericidal action. It is known to be efficient in sterilizing albuminous culture mediums. It is a fat solvent and in proper doses brings about an increase in the permeability of the bacterial cell wall. Certainly the virulence of the infecting organisms must be materially lowered.

Vital resistance is assisted through the induction of an active hyperemia with a resulting influx of lymph bringing

with it an additional amount of immune bodies. Through this increased blood supply, better tissue nutrition naturally results. Caccini claims that the ether transforms the exudate into an autovaccine and auto-antiserum, and that it aids in the disintegration of pus, favoring more rapid absorption. Lienhardt also contends that the reactive inflammation and exudation bring out additional antibodies on the infectious process. In both plants and animals ether has some action as a cell proliferant. Probably its most important action in increasing vital resistance is that of increased phagocytosis. Small doses of ether stimulate the leukocytes to greater activity, whereas large doses paralyze them. The leukocytes having a lipoid surface will become more plastic, flexible and mobile after having absorbed ether in small quantities. The activity of the leukocytes is increased and consequently there is an increase in their phagocytic function. As De Tarnowsky concluded: "Experimentally and clinically, ether has been proved to be an anti-aggressin, producing or increasing leukocytosis and therefore aiding nature's defenses against infection."

In the case of the action of ether in peritoneal infection, there must be some effect on peristalsis. Lienhardt observed that the local chilling from the ether stimulates the bowel and vessels to contract and thus promoted peristalsis and circulation. Waterhouse noted that the bowel recovers its tone more quickly and flatus is expelled sooner. The same observation was made on the reported series of 38 cases. After all, it is most likely that it is the material inside the bowel which leads to a fatal outcome, rather than that on the outside! In other words, most patients who die from peritonitis, do not do so from the toxic material absorbed from the peritoneal cavity, but from that absorbed from inside the bowel, due to stasis, either organic or paralytic. A sluggish or quiet bowel certainly contributes to delayed and stormy convalesence, or death. Based on this hypothesis, Finney reported a series of approximately 150 cases of ruptured appendix in which a careful peritoneal toilet was done, the wound closed without drainage and active measures to induce peristalsis begun almost immediately after the operation. In this series there were no deaths, recovery was prompt and the patients were in bed only slightly longer than those with uncomplicated acute

appendicitis! With proper bowel elimination, in spite of varying degrees of peritonitis, these patients recovered. In most of the patients in whom ether was used intraperitoneally, certainly in those under a general anesthetic, increased motility of the bowel was noted at the time of or immediately following the development of an hyperemia. Probably this is the most important action in bringing about an agreeable convalescence.

Corbett found in the experimental laboratory that the use of ether intraperitoneally following escape of infectious material on the peritoneum does seem to lessen the formation of adhesions. There has been no evidence of adhesions of any consequence in the reported series.

That ether does not hamper the defensive agents of the body or the resistance of the tissues is proved by the fact that it does not in any manner interfere with the healing of an aseptic wound.

CONCLUSIONS

1. Ether is not a panacea in infections. There are instances in which it is not effective, but it certainly contributes to a smoother and shorter convalesence, lessens the degree of infection and lowers the mortality.

2. It is not devoid of danger and should not be used in excessive doses.

3. Its efficiency is due to (a) slight bactericidal action, (b) decreasing the virulency of the invading organisms, (c) the induction of an active hyperemia with (d) better tissue nutrition and (e) the influx of more immune bodies and an increased phagocytosis, and (f) definite stimulation of peristalsis.

4. Convalescence following its use in appendiceal abscess as determined by composite temperature and pulse rate graphs, is closely parallel with the acute uncomplicated cases and the entire series. Those abscess cases with varying degrees of general peritonitis in which ether was not used do not have the same smooth convalescence.

5. Thirty-eight cases of appendiceal abscess with varying degrees of peritonitis without a death and the technic of using ether intraperitoneally, are reported.

REFERENCES

1. Caccini, V.: Ether in Treatment of Peritonitis, Policlinico, (Sez. Chir.) *30:* 558 (April 30) 1923; abst. J. A. M. A. *81:* 511 (Aug. 11) 1923.
2. Caccini, V.: Ether in Treatment of Peritonitis, Policlinico, (Sez. Chir.) *30:* 590 (May 7) 1923; abst. J. A. M. A. *81:* 614 (Aug. 18) 1923.
3. Corbett, J. F.: Peritoneal Adhesions, Surg., Gynec. & Obst. *25:* 66 (Aug.) 1917.
4. Cubbins, W. R., and Abt, J. A.: A Preliminary Report Concerning the Effect of Foreign Substances in the Peritoneal Cavity, Surg., Gynec. & Obst. *22:* 571 (May) 1916.
5. De Tarnowsky, G.: Sulphuric Ether Lavage in Infections: The Souligoux-Morestin Method, J. A. M. A. *62:* 281 (Jan. 24) 1914.
6. De Tarnowsky, G.: Ether Lavage: Its Logical Use, Locally, as an Antiaggressin, Surg., Gynec. & Obst. *37:* 76 (July) 1923.
7. Deganc, F.: Advantages of Rinsing the Abdominal Cavity with Ether in Perforation Peritonitis, Wien. Klin. Wchnschr., *26:* 1338 (Aug. 14) 1913; abst. J. A. M. A. *61:* 1082 (Sept. 27) 1913.
8. Fantozzi, G.: Ether in Surgical Infections, Policlinico, (Sez. Chir.) *27:* 19 (Jan.) 1920; abst. J. A. M. A. *74:* 1132 (April 17) 1920.
9. Fantozzi, G.: Intra-abdominal Use of Ether, Policlinico, (Sez. Chir.) *27:* 41 (Feb. 1920; abst. J. A. M. A. *74:* 1611 (June 5) 1920.
10. Finney, J. M. T., Jr.: Personal communication.
11. Gutnikoff, B.: Ether in Prophylaxis and in Diffuse Purulent Inflammation of the Peritoneum, Zentralbl. f. Chir. *52:* 574 (March 14) 1925; abst. J. A. M. A. *84:* 1464 (May 9) 1925.
12. Lienhardt, B.: Ether Treatment in Peritonitis, Schweiz. med. Wchnschr. *51:* 647 (July 21) 1921; abst. J. A. M. A. *77:* 976 (Sept. 17) 1921.
13. Morestin: Quoted by De Tarnowsky.
14. Naujoks, H.: Experimental Intraperitoneal Injections of Ether, Monatschr. f. Geburtsch. n. Gynak. *60:* 265 (Oct.) 1922; abst. J. A. M. A. *80:* 1278 (April 28) 1923.
15. Phelip and Tartois: Ether for Lavage of the Inflamed Peritoneum, Ann. de Gynec. et d'Obst. *40:* 698 (Dec.) 1913; abst. J. A. M. A. *62:* 494 (Feb. 7) 1914.
16. Philipps, E.: Bactericidal Effect of Ether on Pyogenic Organisms, Munch. med. Wchnschr. *69:* 1112 (July 28) 1922; abst. J. A. M. A. *79:* 1559 (Oct. 28) 1922.
17. Saliba, J.: Antiseptic Action of Ether in Peritoneal Infections, J. A. M. A. *66:* 1295 (April 22) 1916.
18. Saliba, J.: Ether Therapy in Surgical Infections and Its Effect on Immunity, New York M. J. *107:* 157 (Jan. 26) 1918.
19. Schleussner, A.: Ether in Peritonitis Therapy, Munchen. med. Wchnschr. *74:* 1091 (July 1) 1927.
20. Sigwart. —: Ether Therapy and Prophylaxis of Peritonitis, Munchen. med. Wchnschr. *69:* 500 (April 7) 1922; abst. J. A. M. A. *79:* 86 (July 1) 1922.
21. Souligoux: Quoted by De Tarnowsky.
22. Waterhouse, H. F.: Employment of Ether in Surgical Therapeutics, Brit. M. J. *1:* 230 (Feb. 16) 1915.
23. Wright, Sir A. E.: An Address on Wound Infections, Brit. M. J. *1:* 665 (April 17); 720 (April 24); 762 (May 1) 1915.

TETANY FOLLOWING THYROIDECTOMY:

Report of Two Cases With Four Years' Observation

BEN HILL CLIFTON, M. D., F. A. C. S.
Atlanta

TETANY is due to hyper-excitability of the neuromuscular system resulting in all probability from a disturbance in the metabolism of calcium. It is manifested by intermittent tonic muscle spasm, usually symmetrical and most frequently involving the flexor muscles of the extremities, especially the upper. Usually there are premonitory symptoms such as numbness and tingling of the fingers and toes, stiff joints, weakness and sometimes confusion and loss of appetite. This premonitory period is variable and the attack varies from slight spasm of a single muscle or group of muscles, to complete loss of consciousness, with spasm of all the muscles, including the laryngeal. The duration of the attack varies from a few minutes to days. It may follow or be caused by several conditions, such as rickets in children, chronic diarrhea, infectious disease, rapid successive pregnancies or it may follow operation on the thyroid gland associated with injury or removal of parathyroid glands. My two cases both followed operations for hyperthyroidism. It was this type that led to the experimental work demonstrating the relationship of the parathyroid glands to tetany. McCallum and Voegtlin demonstrated in 1908 that the removal of the parathyroid glands was followed by tetany and a reduction in blood calcium and that the tetany was relieved and the blood calcium restored by the intravenous injections of calcium salts. It is apparent therefore that the chief interest in this condition centers around calcium metabolism.

Calcium in the blood is necessary for the formation of bone, coagulation of blood and the maintenance of a proper environment for the living cells. About four times as much is required for a growing child as for an adult. In 1925 Collip isolated parathyroid hormone. When given subcutaneously

Read before the Sixth Annual Assembly of the Southeastern Surgical Congress, in Jacksonville, March 11, 12 and 13, 1935.

or intravenously this relieves the symptoms of tetany and also raises the calcium content of the blood. If given continuously it would raise the calcium level to double the normal amount; the nitrogenous content being greatly increased and the blood concentrated—a condition of hypercalcemia.

Barr, Bulger and Dixon reported a case in 1930 due to a hyperfunctioning adenoma of the parathyroid gland, associated with rarefaction of bone, bone cysts, muscular weakness and formation of calcium stones in the bladder with an increased calcium content of blood and urine. Removal of the adenoma resulted in improvement of patient. Since then several similar cases have been reported.

That other factors enter into the causation of tetany other than lowered blood calcium is demonstrated clearly in a case report by McGhie: frequently when the patient was symptom free and feeling fine, the blood calcium was low (6 mg.) and during generalized convulsive seizures the calcium was 8.86 mg. per 100 c.c. of blood. This case had been observed seven years and demonstrated the increased demand put on the parathyroids during menstruation, diarrhea and acute infections because all of the symptoms became aggravated during these periods.

The ever present possibility of abnormally placed parathyroid glands and the difficulty with which they are identified at operation, and the increasing number of thyroid operations, with the tendency toward more radical removal especially in cases of the hyperplastic type, make it probable that there will be an increasing number of cases of tetany seen unless more careful attention is given to the parathyroids at operation. There is more danger of damage to the parathyroids in operations for recurrent goiter due to fibrosis and change of normal anatomic relations.

The condition may be temporary, due to pressure from bandage, accumulation of serum or clot, infection or trauma, all of which temporarily interfere with the blood supply of the parathyroid glands.

Richter and Zimmermann in a postoperative study of 100 consecutive cases of goiter found evidence of latent tetany in 14, thus demonstrating the frequency of the condition. Symptoms became manifest in only two and they were not of a severe grade. In some of the positive cases a lowering of the

blood calcium was noted but on the whole there was no marked difference in the calcium level in the blood in the tetanic and non-tetanic cases. They concluded that the calcium deficiency was an associated condition rather than the actual cause of the tetany. However, in the majority of cases of active tetany the serum calcium varies from 5 to 8 mg. per 100 c.c. of blood, whereas in the latent cases the serum calcium is normal or only slightly reduced.

That the parathyroids can be identified and protected at operation has been demonstrated by Terry and Searls. By maintaining a bloodless field and preserving the lateral and posterior parts of the capsule, and actually recognizing the glands by their characteristic color, they have been able in their last 1,265 operations to reduce the incidence of parathyroids on removed specimens from 30 per cent to 1.6 per cent.

The treatment of tetany is first, prevention; that is, protect the parathyroids from actual removal or trauma during operation, and if found on the removed specimen, transplant them immediately. For active tetany, parathormone should be administered during the acute stage with calcium salts by mouth or intravenously; for the chronic cases, a high carbohydrate diet with calcium in large doses remains the most important treatment. Especially encouraging, however, is the recent work of Stone on endocrine transplantation.

Report of Cases

Case 1.—A white woman, aged 50, was referred to me in September, 1930, with recurrent symptoms of hyperthyroidism. Four years previously the left lobe of the thyroid had been removed followed in two weeks by hysterectomy and the removal of silent gallstones with drainage of the gallbladder. She recovered from these operations and remained well until April, 1930, at which time she consulted her physician for nervousness. Increasing doses of thyroid extract were prescribed until ten tablets per day were taken. There had been a loss of about 25 pounds. In August the basal metabolism had been plus 33. The thyroid tablets were stopped and Lugol's solution prescribed. A few weeks later the metabolism was plus 27.

Slight exophthalmos, an enlarged right lobe of the thyroid and definite tremor were present. Blood pressure was 150 over 84, pulse 88 to 115. The right lobe of thyroid was removed without difficulty on Oct. 29, 1930. The laboratory report was exophthalmic goiter and adenocarcinoma. Suppuration occurred in the wound. About the eighth postoperative day she complained of her fingers tingling and a feeling of numbness at times, but we were so

concerned about the character of the growth that little attention was paid to this. Progress was fairly satisfactory, but she complained of weakness. She was dismissed from the hospital on November 10, with a discharging sinus in the stab wound.

Ten days later, while in my office, she stated that she felt as if her jaws were going to lock at times and her knees felt stiff. There was also some tingling and numbness in her fingers. There was muscle spasm on the dorsal surface of her thumbs. Chvostek's and Trousseau's signs were positive. Calcium lactate, 15 grains three times daily, was prescribed and a high carbohydrate diet advised. She left the office and in about 15 minutes was brought back after having had an attack of some kind. She was pale and covered with cold sweat; the pulse was fast, the forearms were flexed and the thumbs flexed on the palms of her hands. In a short time she felt better and was sent home.

The next day she felt decidedly better but developed diarrhea. Three days later she had an attack of acute epigastric pain and she was sent to the hospital. There was evidence of active tetany, so 20 units of parathormone were given. After repeating this in six hours, the blood calcium was 8 mg. per 100 c. c. of blood. The leukocyte count was 17,500 and there was rigidity over the gallbladder. Calcium lactate was continued and sedatives given. The active tetany cleared up almost immediately. Four days later an abscess around the gallbladder, the exact source of which was not determined, was opened and drained. The tingling and numbness in fingers continued but gradually improved. On December 27, the sinus in her neck was dissected out and she left the hospital on the 31st, much better. Calcium lactate, one dram three times daily, was continued and the patient improved steadily.

On March 6, 1931, the blood calcium was 11 mg. per 100 c. c. of blood but in spite of high calcium there was tingling and numbness in fingers. Some months later after she became rather careless about taking calcium, the symptoms were more noticeable and the calcium had fallen to 8 mg.

On October 10, 1932, the inflamed gallbladder containing stones was removed. However, for fear of possible reactivation of the chronic tetany, calcium lactate was continued.

The patient must still take calcium lactate 2 to 3 drams weekly, for unless she does her symptoms become manifest.

This I believe to be a chronic case of tetany due to damage to the parathyroids on the right side from the inflammatory process. The parathyroids on the left had probably been removed at the previous lobectomy. Her blood calcium now is 8.6 mg. after calcium lactate is omitted for several weeks but the symptoms are manifest, such as tingling of fingers and toes and weakness, especially when she becomes worried.

CASE 2.—A woman, aged 51, consulted me in April, 1930, complaining of nervousness, loss of weight and sleeplessness due to pounding of the heart against chest wall. She was very nervous, with tremor and slight exophthal-

mos. The blood pressure 180 over 90, the pulse rate 120. There was slight enlargement of the thyroid gland. A diagnosis of toxic goiter was made and basal metabolism suggested. She did not return until November, at which time she was feeling much worse. She had been taking thyroid tablets since first consulting me. The basal metabolism at this time was plus 50. The blood pressure was 170 over 90 and the thyroid was uniformly enlarged. After rest and Lugol's solution subtotal thyroidectomy was done on Jan. 3, 1931. Laboratory examination of the specimen showed hyperplasia.

Following the operation she had some difficulty with her voice and in swallowing but this soon cleared up. All along she complained of feeling "queer," the pressure of the bed felt "funny," and she was more or less confused. About the tenth postoperative day she stated her fingers had gone to sleep and that she had to move them constantly to know they were still there. She also noticed at times her fingers tingled. Anorexia worried her because her appetite had been unusually good before the operation. She left the hospital January 11, the incision healed. Calcium lactate was prescribed, 15 grains three times daily, with forced feeding and a high carbohydrate diet.

On February 7, she came in looking pale and complaining of tingling in her fingers and toes and inability to control thumbs. The thumbs were flexed on the palms, the fingers extended but flexed at the metacarpophalangeal joints (obstetric hand). Chvostek's sign was present. Calcium lactate was increased to grains 30 three times daily. That night I was called to see her and found her unconscious, pale, cold with a clammy skin and fast pulse. The inspiratory sound was harsh, simulating the breathing of a child with croup. Thirty units of parathormone were given subcutaneously and in 20 minutes she was conscious and asked what all the commotion was about. The following day she was feeling fine except for slight tingling in fingers. Calcium lactate was increased to one dram three times daily. The blood calcium has varied from 5.3 mg. to 9.03 mg. per 100 c. c. of blood.

For about two years this patient required approximately one ounce of calcium every 24 hours to keep her symptom free and the blood calcium within the range of normal. Since then she has reduced the amount to an average of about 4 drams weekly, and she goes about feeling fairly well. However, as a result of the chronic tetany she is a semi-invalid.

COMMENT

The course of tetany is variable. Though rarely, some patients die during the acute stage. Some clear up within a few hours or days without any special treatment. In many cases the condition becomes chronic with periods of exacerbation of symptoms.

These two cases are reported in the hope that they will remind the profession in this region where goiter is not endemic and where relatively few operations on the thyroid are done that such a complication can and does follow operation. I

assure you that even one case will stimulate the average surgeon to develop a technic to insure protection of the parathyroids.

478 Peachtree Street.

REFERENCES

1. Lahey, F. H.: The Transplantation of Parathyroids in Partial Thyroidectomy, Surg., Gynec. & Obst. *42:* 508, 1926.
2. Richter, H. M., and Zimmerman, L. M.: Latent Postoperative Tetany, Surg., Gynec. & Obst. *44:* 627, 1927.
3. Dragstedt, L. R., and Peacock, S. C.: Pathogenesis of Tetany: Control and Cure of Parathyroid Tetany by Diet, Am. J. Physiol. *64:* 242 (May) 1923.
4. DeQuervain, F.: Goiter and Thyroid Diseases. 1924.
5. Hertzler, A. E.: Diseases of the Thyroid Gland. Second Edition. St. Louis: C. V. Mosby Co., 1929.
6. Jackson, A. S.: Goiter and Other Diseases of the Thyroid Gland. New York: Paul B. Hoeber, Inc., 1926.
7. Barr, D. P.; Bulger, H. A., and Dixon, H. H.: Hyperparathyroidism, J. A. M. A. *92:* 951 (Mar. 23) 1929.
8. Snell, A. M.: Some Recent Advances in Endocrinology, Minnesota Med. *13:* 8 (Jan.) 1930.
9. Luckhardt, A. B., and Goldberg, Benjamin: Preservation of the Life of Completely Parathyroidectomized Dogs, J. A. M. A. *80:* 79, 1923.
10. McGhie, A. G.: Parathyroid Disturbances Following Thyroidectomy: Report of Case. Tr. Am. A. Study Goiter, p. 100. 1933.
11. Terry, W. I., and Searls, H. H.: Further Observations on Parathyroid Protection, West. J. Surg. *41:* 507 (Sept.) 1933.
12. Stone, H. B.; Owings, J. C., and Gey, G. O.: Living Grafts of Endocrine Glands, Am. J. Surg. *24:* 386 (May) 1934.

The Southern Surgeon

Published Bi-monthly by

The SOUTHERN SURGEON PUBLISHING COMPANY

478 Peachtree Street, N. E.

ATLANTA

L. MINOR BLACKFORD, M.D. *Editor*

B. T. BEASLEY, M.D. *Managing Editor*

ROY B. MCKNIGHT, M.D. *Associate Editor*

GILBERT F. DOUGLAS, M.D. *Assistant Editor*

AUGUSTUS STREET, M.D. *Assistant Editor*

Subscription in the United States, $3.00

VOLUME IV APRIL, 1935 NUMBER 2

BI-MONTHLY!!

THE way nature abhors a vacuum has nothing in the world on the way our Managing Editor abhors red ink! Indeed he positively insists that THE SOUTHERN SURGEON shall remain in the black. However, he has found out that it is possible to publish six numbers of the present size this year without getting perilously near the red. If expectations are realized, it will be possible to expand each number to 88 or more pages before 1936.

The success of the Jacksonville Assembly, the great activity among the Fellows of the Congress during the past year, particularly in South Carolina and Florida, the organization of Kentucky, and above all the induction of Virginia into the Congress under the leadership of Dr. Horsley and Dr. Bigger—these things inspire us in the confident belief that the success of The Southeastern Surgical Congress is scarce begun. Under the Presidency of Dr. Haggard great steps forward may be looked for.

The success of the SURGEON now more than ever depends not only upon the contributions of their best by the Old Reliables, but perhaps even more upon the maiden efforts in scientific writing of the many well-trained young surgeons of this great Southland of ours.

FRANKLIN H. MARTIN

FRANKLIN H. MARTIN, a surgeon of large experience, a man of vision, of herculean effort, and of great organizing ability, and editor of the most outstanding surgical publication in the world, has left us.

Envisioning a great body of approved American surgeons to form a solidarity for the upbuilding of the surgical art, for its scientific advancement, for the dissemination of knowledge and for the equalization of practice, he first launched in 1910 the Clinical Congress. It convened in the greater cities of this country and then in London in 1914, after the Congress had been broadened into the American College of Surgeons. It was meet that its first large convocation should be held in the metropolis of the English speaking peoples, as it included Canada and later the Latin-American countries. Dr. Martin was Director-General from its inception.

During the World War Dr. Martin was a member of the Council of National Defense, and as Chairman of its Medical Board he wrought with great intelligence and efficiency.

Son of Wisconsin by birth, gynecologist by profession, teacher, author, scholar and man of affairs: his mark has been indelibly placed upon American surgery. The building of the Murphy Memorial as part of the headquarters of the American College of Surgeons, forms, with its library and museum, a great center for radiation of surgical knowledge. *Surgery, Gynecology and Obstetrics* by his will becomes part of the great endowment of the College, which he perfected.

During his seven and seventy years he was a stormy petrel, eager for the advancement of his profession and the science and art of surgery. He was a dreamer—his dreams came true. He dreamed for American Surgery; he awoke to a realization of a great institution for the betterment of mankind and for the upbuilding of surgery on the North American Continent. He died of coronary thrombosis on March 7, 1935, while actively engaged in efforts to guide aright national medical legislation.

Another chief was carried
From life's battle on his spears
To the dim Valhalla cloisters
Of the ever living years.

W. D. HAGGARD.

THE FUTILITY OF GLUCOSE PER RECTUM

THE application of the nutritional principle that "fats burn in the fire of carbohydrates" to the prevention and treatment of acidosis before and after operations has reduced enormously the hazards of major surgery. This is particularly true in gastric operations when sufficient food and fluids cannot be given by mouth to nourish the patient properly and prevent dehydration.[1] The surgeons are indebted to their medical confreres for aid in the solution of their problems of acidosis and dehydration.

The free use of orange juice, lemonade and other fluids containing soluble carbohydrates by mouth, and the subcutaneous and intravenous use of dextrose and glucose solutions, with the use of insulin when indicated, will prevent and relieve surgical acidosis; but the rectal employment of glucose and dextrose solutions, whether given by the Murphy drip, or the other so-called nutrient enemas, in the light of recent observations seem not only valueless but actually harmful to the surgical patient. Likewise, the principle of "pushing fluids" and the use of saline solutions to prevent dehydration, while of great value when properly applied, may be overdone.

Recent studies seem to prove that very little, if any, dextrose or glucose is absorbed from solutions given by the rectum. McNealy and Williams,[2] in their experimental studies on the absorption of glucose from the colon, concluded that in dogs there is little or no absorption of glucose or dextrose through the colonic mucosa. Pressman[3] apparently proved that following the introduction of dextrose into the rectum there is a reduction in the blood sugar content so that there must either be no absorption of dextrose from the colon, or the little sugar that may be absorbed is stored in the liver.

DeTakats[4] investigated the blood sugar of a normal man after an average meal, after the introduction of 1000 c.c. of 5 per cent dextrose subcutaneously, and after the rectal administration of 1000 c.c. of a 5 per cent dextrose by the Murphy drip: the sugar content of the blood rose after the normal meal, and after the administration of 5 per cent dextrose by hypodermoclysis, while after the rectal drip the blood sugar level fell. Not only was there no utilization of the dextrose given per rectum to a normal man, but there was gaseous dis-

tention and discomfort following its use, which deTakats thought was due perhaps to changing the flora in the colon and to the distention from the unabsorbed fluid. No doubt much of the flatulency and other abdominal discomfort following operations of all kinds is due to the routine use of dextrose solutions given per rectum.

Schmidt[5] in studying blood sugars of non-diabetics a few hours before death found low sugar concentration in the blood of three postoperative patients who had been receiving a 5 per cent glucose solution by the Murphy drip method. It, therefore, seems that both from experimental and clinical studies, the use of glucose or dextrose solutions via the rectal route not only is futile, but may be actually harmful to patients either before or after operation. Many surgeons now wisely spare the rectum except for the use of plain warm water given either as a cleansing or a retention enema.

Trout[6] years ago protested against the then indiscriminate postoperative use of salt solutions per rectum, because he considered an excess of salt in the blood and tissues of the body might be actually harmful to the surgical patient. Instead of the salt solutions he advised the liberal use of tap water per rectum. Moynihan[7] uses carbonate of soda with glucose solution to prevent acidosis before and after abdominal operations, but he advises against the use of salt solution. Unquestionably the normal salt solution may be partly, or wholly, absorbed through the colonic mucosa, and if too much is given, particularly to the patient with damaged kidneys, the sodium-calcium-potassium balance of the blood is disturbed, and the excess of salt in the tissues may cause edema of the lungs and other parts of the body from water retention.

It may be best to discontinue the use of the so-called normal salt solution altogether before and after operations, except where carefully checked laboratory studies of the blood shows a low salt content as in alkalosis and in intestinal obstruction. It would seem rational to use instead not more than 1000 c.c. a day of Ringer's solution which combines sodium, calcium and potassium in the same ratio as in the normal blood. The Ringer's solution may be given rectally or with glucose solutions either subcutaneously or intravenously.

In a very timely article on the dangers of the surgeon's order to "push fluids," deTakats[4] calls attention to "the fear of

dehydration that has swept the country." DeTakats thinks that 3000 or 4000 c.c. in twenty-four hours is as much fluid as a patient should have before or after any operation; and that where there is myocardial damage, or kidney insufficiency, or both, the fluid intake should be reduced very materially. The dehydrated, oftentime undernourished, patient frequently has some cardiorenal damage; and a weak heart may fail, and poorly functioning kidneys may allow water retention with the symptoms of what Rountree[8] calls "water intoxication" if an excessive amount of fluids is given.

There is always the question of how much of even plain water is absorbed from the colon. If it is retained in the colon and not absorbed, it adds to the abdominal distention and the water balance of the body is low; whereas, if too much is absorbed there is danger of overburdening a weak heart, or that damaged kidneys may cease to function with the added burden of eliminating an excess of fluid. The indiscriminate use of the Murphy drip with even plain warm tap water may be the deciding factor against the recovery of a patient of low vitality who has trusted his life to the surgeon of his choice.

Certainly the safest and the most accurate method of administering dextrose solutions, Ringer's solution, or saline solution before or after operations is intravenously. The rectum should not be disturbed in a futile attempt to nourish any patient whether surgical or medical, by the use of glucose, or other so-called nutrient enema, but should be reserved for the use of plain water, which may be absorbed and thus aid in establishing the water balance in cases in which dehydration may be a factor.

If the preoperative or postoperative patient cannot take fluids by mouth and the surgeon feels that he must give fluids per rectum, he must be sure that he will not do anything that may reduce the patient's chance for recovery; and undoubtedly the safest, surest and most comfortable method of administering fluids via the rectal route is the use of 200 to 300 c.c. of plain warm water given slowly through a soft rubber catheter every 2 or 3 hours. Some prefer the less certain Murphy drip method of giving water per rectum.

Whatever may be the method of administering fluids, whether orally, rectally, subcutaneously or intravenously, except in rare cases, not more than 3000 to 4000 c.c. should be

given within twenty-four hours. The surgeon should see to it, however, that every postoperative case, except the underweight asthenic patient with low vitality, should have approximately 3000 c.c. of fluids a day. The preoperative and postoperative application of the well-known physiologic principles of carbohydrate and fat metabolism and water balance in the tissues not only saves lives, but adds peaceful nights and comfortable days to the life of the wise surgeon.

SEALE HARRIS, M. D.

REFERENCES

1. Harris, Seale: (a) Dietary Management of Peptic Ulcer Patients Before and After Operations, South. M. J. *24:* 1065 (Dec.) 1931. (b) Curing the Ulcer Patient, Ann. Int. Med. *4:* 149 (Aug.) 1930. (c) Dieting the Medical and Surgical Ulcer Patient, J. Oklahoma M. A. *26:* 287 (Aug.) 1933.
2. McNealy, R. W., and Williams, J. D. The Absorption of Glucose from the Rectum, Surg., Gynec. & Obst. *49:* 794-798, 1929.
3. Pressman, J. J.: The Absorption of Glucose per Rectum, Am. J. M. Sc. *179:* 520 (April) 1930.
4. DeTakats, Geza: Push Fluids, the Surgeon's Postoperative Order, Am. J. Surg. *11:* 39 (Jan.) 1931.
5. Schmidt, E. G.: Terminal Hypoglycemia, Arch. Int. Med. *47:* 128 (Jan.) 1931.
6. Trout, Hugh: Proctoclysis: An Experimental and Clinical Study. South. M. J. *6:* 791 (Dec.) 1913.
7. Moynihan, Sir Berkley: Two Lectures on Gastric and Duodenal Ulcer. New York: William Wood and Company, 1932.
8. Rountree, L. G.: Water Intoxication, Arch. Int. Med. *32:* 157, 1923.

THE JACKSONVILLE ASSEMBLY

FOR the first time in history, The Southeastern Surgical Congress invaded Florida for its Sixth Annual Assembly. With ten States in the Congress now, it is getting to be quite a problem for a peripatetic organization like the Congress to visit each of its component States, which will cause many of us to regret that the Assembly cannot be staged in Jacksonville every year. Perhaps our gallant hosts will be consolable, for evidently many men put in many hours of hard work to insure the success of the meeting.

The first scientific Assembly had 36 papers on the program, of which only 9 were by Southern men: the 1935 Assembly had 30 papers, of which 24 were by Southerners. The papers this year were grouped as symposia, which resulted in many surgeons only attending the sessions in which they were particularly interested. This fact, coupled with the absence of medical students, made the attendance seem smaller than in fact it was. The actual number of physicians registered compares favorably with that of earlier meetings.

The 1935 Assembly was further characterized by the excellence and variety of the scientific exhibits. Dr. Addison G. Brenizer, of Charlotte, in addition to his famous presentation of goiter cases, gave a moving picture to illustrate his modification of the Coffee technic of transplanting the ureters, and displayed illustrations of neurologic and plastic surgery. Dr. Lucien Y. Dyrenforth, of Jacksonville, had a creditable display of specimens of surgical pathology.

Atlanta was generously represented by exhibitors. Drs. Lawson Thornton and Calvin Sandison, in addition to a goodly array of less spectacular orthopedic work, showed in moving pictures their recently perfected treatment of fracture of the hip which allows the patient to walk at once. Dr. Roy R. Kracke displayed a summary of his work on the etiology of granulopenia, which has attracted so much attention at recent conventions of the American Medical Association. Dr. Jack C. Norris had some splendid pictures in color of various types of fibroid tumors. Dr. Murdock Equen, with his exhibit of biplane fluoroscopy in bronchoscopic work, showed results of his work on cancer of the larynx,—including a laryngectomized patient. Dr. L. G. Baggett displayed photographs and drawings of uretero-intestinal anastomosis, as well as the patient.

The Assembly was called to order the morning of March 11, by President Gerry R. Holden. The Invocation was pronounced by the Rev. Albert J. Kissling, of the Riverside Presbyterian Church. Mayor John T. Alsop, Jr., extended a singularly gracious welcome on behalf of the City of Jacksonville. It was very easy for the outlanders present to understand why Mayor Alsop occupies the position he does in the heart of the Gate City.

Dr. Jerre Watson, of Anniston, delivered the inspiring memorial address, characterized by sentiment and dignity. He gave a brief account of the lives of the four Fellows of the Congress who had died since the last Assembly:

THOMAS FRED JACKSON
March 30, 1888—March 21, 1934
Dade City, Fla.

DAVID THOMAS TAYLOE
Sept. 12, 1895—Sept. 14, 1934
Washington, N. C.

PHILIP HENRY STEWART
Dec. 24, 1867—Oct. 8, 1934
Paducah

GASTON HOLCOMBE EDWARDS
Aug. 18, 1875—Dec. 29, 1934
Orlando

It is unnecessary here to comment on the scientific papers presented for they will be published in these pages. Two of the scheduled speakers were absent: Dr. George Crile, on account of the funeral of Dr. Franklin H. Martin, and Dr. Ralph N. Greene, through reason of his own illness. Admirable substitutes were found in Dr. James G. Lyerly and Dr. Robert B. McIver, both of Jacksonville, and Dr. Murdock Equen, of Atlanta.

Dr. Lyerly spoke on subdural hematoma, a paper which we shall publish. Dr. McIver presented thumbnail case reports of various renal conditions to bring out points in differential diagnosis with many good x-ray lantern slides. It is regretted that the SURGEON cannot use all of the films exhibited.

Dr. Equen's patient whose larynx had been removed for carcinoma grade 4 more than two years previously, demonstrated his artificial larynx before the microphone. In addition, Dr. Equen reported in outline a case of partial esophagectomy for carcinoma of the upper esophagus, the growth having been exposed by laryngectomy.

Dr. Arthur E. Hertzler, of Halstead, Kansas, substituted for Dr. Crile in the first clinic of the session. A case was presented of a young man who had undergone partial thyroidectomy, for exophthalmic goiter several years before. He was still suffering symptoms suggestive of goiter in spite of a normal basal metabolic rate. Dr. Hertzler said that he would like to have an opportunity to study sections of the removed thyroid before committing himself definitely. However, in view of the reputation of the surgeon who had operated, he felt justified in accepting the original diagnosis as correct: assuming this, the patient should now sacrifice the remainder of his thyroid gland regardless of his metabolic reading. He insisted that "a surgeon should have more brains than a tin can." Dr. Hertzler felt that the dangers of myxedema from radical thyroid surgery had been vastly exaggerated, and stated that Kocher, in his original article in 1888, had observed myxedema following total thyroidectomy in adolescents only.

Dr. Haggard talked about the surgical management of toxic goiter with lantern slides. There is only one Dr. Haggard.

Dr. C. Jeff Miller, of New Orleans, gave a clinical talk on "The Early Diagnosis of Carcinoma of the Cervix." He emphasized the fact that the

symptoms usually related as attracting suspicion of carcinoma, i. e., bleeding, leukorrhea and pain, are really old symptoms, and we should revise our teaching in regard to this matter; that biopsies should be more frequently done, and the use of the Schiller test and the colposcope are valuable adjuncts in the diagnosis of really early carcinoma. All tissue removed by curettage and plastic operations on the cervix should be routinely and carefully studied microscopically, because many of our early cases of carcinoma are found when one believes that one is dealing with a simple infection of the servix. He also believes that prophylaxis, such as repair of obstetric injuries of the cervix, and eradication of chronic infection, would probably prevent more cases of carcinoma than we are curing with our present methods of treatment.

The clinic of Dr. John F. Erdmann, of New York, was based on cases of gallbladder disease with stones.

In discussing point by point the case presented to him for a clinic, Dr. Hugh Cabot, of Rochester, Minnesota, said, "Always determine the source of hematuria as soon as possible." Tenderness in the costovertebral, or, as he preferred to say, costomuscular angle usually means inflammation around the kidneys. In this case, the tests "prove conclusively that he has 25 per cent of one kidney functioning normally, but nothing else. The phenosulphonphthalein test (as well as all the other tests) is entirely unreliable in the presence of stone. It doesn't prove the kidney's function is impaired." He advised in cases of bilateral stone, to operate on the better kidney first.

He also discussed Wilms' tumors.

Dr. Hertzler's second clinic concerned acute cholecystitis. He stated that watchful waiting was often advisable, but that if the gallbladder did not regress, drainage was the operation of choice. In his experience, the removal of an acutely inflamed gallbladder had often been followed by pulmonary embolism. At the same time he agreed that the gallbladder should be removed promptly after subsidence of the acute inflammation.

The first case presented to Dr. Paul G. Flothow, of Seattle, was a postfracture paralysis of the radial nerve. He thought that this had resulted from pressure of the cast and that, since the boy was improving, orthopedic manipulation should be continued. "We are prone to operate too quickly on peripheral nerves." A case of the Brown-Sequard syndrome resulting from an inflammatory transverse myelitis in a school girl and of diabetic gangrene in a man of 55 completed the session.

The banquet was perhaps the most delightful that the Southeastern Surgical Congress has yet enjoyed. Dr. J. Knox Simpson was Toastmaster. Dr. W. D. Haggard toasted "The Southeastern Surgical Congress," Dr. Frank K. Boland, "The Ladies," and Dr. Roy J. Holmes, "Florida." Each speaker, with admirable self-restraint, spoke with the soul of wit. Music and dancing, both by professionals and by the surgeons and their wives, rounded off a wonderful evening.

The visiting ladies were entertained royally by the wives of the Jacksonville Fellows, headed by Mrs. Fred Waas. Their program consisted of a lunch at the Florida Yacht Club on Monday, a drive to the Beach with tea at Ponte Verde Club on Tuesday, and Wednesday morning a "Microbe Party" in the hotel. In addition, many informal parties were given the visit-

ors. In passing, some of the wives' husbands reported that the Florida golf courses were all they were cracked up to be.

Dr. Gerry R. Holden, the retiring President; Dr. W. S. Manning, Chairman of the Entertainment Committee; Dr. Shaler Richardson, of the Publicity Committee; Dr. Alan Brown, of the Transportation Committee; Dr. J. Knox Simpson, of the Clinics Committee, and Dr. Fred Waas, of the Hotels Committee, and their associates deserve undying thanks for their hard work in making the Assembly a success.

Many members of the Duval County Medical Society who were not Fellows of the Congress cooperated freely and cheerfully in putting over the convention. Chief among these must be mentioned Dr. W. McL. Shaw, who closed his office for the entire time of the meeting in order personally to handle the electrical equipment. The microphone, the lantern and the moving picture projector, thanks to Dr. Shaw, all worked so perfectly that their perfection could hardly be noticed. Dr. Stewart Thompson also helped enormously in technical matters.

At the business meeting, Dr. C. Jeff Miller, of New Orleans, was made President-Elect; Dr. Carl C. Howard, of Glasgow, Kentucky, Vice-President. Dr. B. T. Beasley was re-elected for a three-year term as Secretary-Treasurer. Dr. I. A. Bigger, of Richmond, was appointed Chairman of the Virginia Executive Committee, and Dr. J. Shelton Horsley was appointed to aid him. New Orleans, which had invited the Congress to meet there before, again extended an invitation, this time through the gracious person of Dr. Miller. The invitation was accepted and New Orleans was selected for the 1936 Assembly. The dates will be March 2, 3 and 4.

BOOK REVIEWS

The Editors of THE SOUTHERN SURGEON *will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.*

A TEXTBOOK OF SURGERY FOR STUDENTS AND PHYSICIANS. By W. WAYNE BABCOCK, M. D., LL. D., F. A. C. S., Professor of Surgery and of Clinical Surgery in the Temple University; Surgeon to The Temple University Hospital and to the Philadelphia General Hospital, Chief of the Surgical Service, U. S. General Hospital No. 6, 1917-1919. Second Edition. Rewritten. 1,312 pages with 1,032 illustrations and 8 plates in color. Price, $10. Philadelphia and London: W. B. Saunders Company, 1935.

Readers of THE SOUTHERN SURGEON, to which he has contributed so generously, will be glad to welcome the second edition of Dr. Babcock's Surgery. This has been extensively revised and many sections completely rewritten. It brings surgery up to the very present in a most satisfactory way and the SURGEON hopes that this edition will be as widely distributed as the first.

The orthopedic chapters stand out even in this work. The section on abdominal surgery, particularly that dealing with peritonitis, is also particularly fine. However, the reviewer feels that Dr. Babcock has made the diagnosis of "chronic appendicitis" appear too simple, for it would seem that this condition is diagnosed more frequently than it occurs.

In view of Dr. Babcock's own valuable contributions to gynecology, it is rather surprising to see this subject entirely omitted. Otherwise the book seems to be, if anything, too complete. Some of the very rare conditions are dealt with more fully than their occasion would seem to warrant and one wonders, too, why the routine treatment of gonorrhea and syphilis, even when as well and as authoritatively written as here, should be included in a work on surgery.

Despite these minor criticisms, this is a swell book. The detailed illustrations make many of the operations look so simple that one almost feels a schoolboy could do them.

SURGICAL APPLIED ANATOMY. By SIR FREDERICK TREVES, Bart. Revised by C. C. CHOYCE, M. D., Edin., F. R. C. S. Eng., Professor of Surgery, University of London, etc. Ninth Edition. 174 figures, 66 in color. Price, $4. Philadelphia: Lea & Febiger, 1934.

For more than half a century medical students have found Treves a great help in reviewing for examinations and even after graduation many of them have kept their copy for convenient reference. The new edition has been thoroughly revised and brought up to date by Mr. Choyce, who has added a number of illustrations from roentgenograms. He has, however, managed to preserve many of Sir Frederick's anecdotes as well as his inimitable style. Aside from its great practical value, the book is good reading.

MODERN OPERATIVE SURGERY, edited by G. GREY TURNER, M. S., F. R. C. S. Eng., F. A. C. S. (Hon.), Professor of Surgery, University of Durham, etc. Second edition. Two volumes, 1764 pages, with 871 illustrations. Price, $15. Baltimore: William Wood & Company, 1934.

These beautiful volumes from our English brethren in the craft are delightful. The Britishers do know how to handle our mutual mother tongue and this work, like so many of their scientific publications, really rates as literature. Nearly all of the surgeons whose reputations are familiar to us on this side of the Atlantic are well represented. It is refreshing to gain their points of view.

The volumes carry the defects of most revisions, especially when done by a number of authors, and even more particularly when some of the original writers have died and their successors have great reverence for them, namely, that the various parts are not evenly brought up to the present. Surgical statistics of twenty or thirty years ago, like the flowers that bloom in the spring, have nothing to do with the case today.

The section on surgery of the sympathetic nervous system is about the best thing on the subject this reviewer has seen. That on surgery of the larynx and of the esophagus is just about as good. On the other hand, the chapters on goiter are not impressive, and the man who wrote of the treatment of ileus and peritonitis apparently did not know of the studies of Wangensteen, Orr and Ochsner.

"Operative Surgery" is fully and clearly covered. The illustrations illustrate and they are quite adequate. In view of the title of the work, one should not be too critical of the inadequacies of the diagnostic sections. On the other hand, prognosis, in most chapters, is handled peculiarly well.

The common sense on which all Englishmen pride themselves and the clinical sense which has so distinguished the English physician for centuries, are apparent throughout. And the volumes are beautiful.

PRACTICAL NEUROLOGICAL DIAGNOSIS, WITH SPECIAL REFERENCES TO THE PROBLEMS OF NEUROSURGERY. By R. GLEN SPURLING, M. D., Assistant Clinical Professor of Surgery, University of Louisville School of Medicine. Pp. 233, with 99 illustrations. Price, $4. Springfield and Baltimore: Charles C Thomas, 1935.

This little book lives up to its title perfectly. It should prove indispensable to students and interns—and, indeed, it should prove of great value to all surgeons and general practitioners. As was brought out in one of the papers read in Jacksonville, the average physician is not sufficiently alert to recognize many neurologic conditions and you can't find them if you don't look for them. The work does not pretend to teach neurologists and neurosurgeons what they should not already know, but even they may find it convenient and interesting.